

**CLASS 164, METAL FOUNDRY****SECTION I - CLASS DEFINITION**

This is the generic class for:

1. METAL\* CASTING - Process and/or apparatus for shaping of fluid metallic material.
2. MOLD MAKING - Process and/or apparatus, per se, for shaping of fluent material to produce a forming surface to carry out in METAL\* CASTING, supra.
3. PATTERN MAKING - Process and/or apparatus for shaping a fluent material to produce a form or pattern to be used in MOLD MAKING, supra.
4. PRODUCT TREATING - Process and/or apparatus for treating, mixing, or mechanically working the metallic material while molding or while the metallic material is in a mold, i.e., while carrying out an operation of METAL\* CASTING, supra.
5. OTHER - Process and/or apparatus not elsewhere provided for to perfect or effect METAL\*CASTING or MOLD MAKING, supra.

\*Throughout this class, the term "metal" is to include pure metal, metal alloys and inter-metallic compounds.

**AMPLIFIED STATEMENT OF CLASS SUBJECT MATTER.**

This class in general provides for the foundry operations including from those of making the molds and patterns to those of casting a final metal product. These operations, particularly that of casting the metal, do not have to be limited to a foundry operation in the locational sense; but may be performed in any physical location, e.g., cast-welding rail ends in the field.

The metal casting of this class involves the shaping of a free flowing liquid metal and as such is distinguished from other forms of metal deformation such as metal bending, forging, billet extrusion, etc., where the metal is never free flowing. Also a shaping surface is required for placement in the class. For example, forming metal by a shot tower will be found elsewhere. The shaping surface, though, may remain as part of the final product. (See References to Other Classes, below).

The mold making procedures provided for in this class are generally of the sand shaping type although any fluent material is included such as metal, plaster of paris,

ceramic materials and synthetic plastics. There molds so formed are limited to use in metal casting operations and are not of general utility. Making molds by shaping of solid materials are found in the particular shaping classes except where the operation is combined with a subsequent metal casting step; in such a case, the operation is provided for in this class.

The pattern making procedures provided for in this class are those of shaping a fluent material such as wax and other plastic materials. Shaping a pattern from solid material such as by cutting from wood are provided for in this class only when followed by a further foundry operation such as forming a sand mold by using the pattern.

The metal product treating operations provided for in this class are those that are performed in conjunction with a metal casting operation. Alloying of metals while pouring the metal into a mold or while the metal is in a mold is provided for in this class. Any reshaping of the metal while in the mold such as cutting, or solid deforming are provided for in this class. Also, particularly in the case of a continuously casting operation, the rolling or bending of the continuously cast product (where the casting is also claimed) is provided for herein if some of the contiguous product is still in the mold.

Other miscellaneous adjuncts which are used to perfect a foundry operation are provided for in this class if there is not a specific class which provides for the subject matter. The main items of this type are flasks, mold jackets, strippers, and core supporting devices, e.g., chaplets. See Subclass References to the Current Class, below.

**SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS****A. MOLDING PROCESS AND APPARATUS CLASSES****1. Molds Without Structure.**

A mold recited only by composition with no structure recited will go to the appropriate composition class. See References to Other Classes, below.

Patents wherein all the claims are limited to a mold mentioned by name only with no structure recited and defined only in terms of the composition of individual

layers are classified in the appropriate composite layer class. (See References to Other Classes, below.)

## 2. Metal

Class 249 provides for molds of a static character for metal shaping. Generally any mold having a dynamic feature of the feature of the following list is included in this class (164):

- (a) A mold combined with means or pressing molding material within the mold.
- (b) A mold combined with a cover having projections penetrating into the fluent hardenable material upon movement of the cover to its operative position.
- (c) A mold combined with means for moving the mold from one side to another.
- (d) A mold formed of separable and unconnected parts combined with means to individually handle each part for assembly.
- (e) A mold provided with a core or ejector combined with a machine-type means for actuating the core or ejector.
- (f) A mold combined with means to position the work relative to the mold and which means functions to release the work to permit it to fall in the mold.
- (g) A mold or core combined with means for creating differential pressure within the mold or core for dynamically shaping a molding material.
- (h) A mold combined with means for feeding material thereto, except that a mold with an integral funnel element or a mold so modified to provide structure especially designed for supporting a feeding means, is classified in Class 249.
- (i) A mold and means to vibrate the mold.
- (j) A segmented female mold or core, e.g., tunnel type, etc., and power means, i.e., motor to move the segments to inoperative or operative position.
- (k) Continuous or semi-continuous forming apparatus.

Also, Class 249 provides for all static molds for metal shaping except for molds made of sand or a similar particulate material which is found in this class (164). See Subclass References to the Current Class, below, for a

subclass reference for mold made of sand or a similar particulate material. A mold which by claim or disclosure can be either sand or metal will be found in Class 249. Combinations of sand and metal molds or cores are provided for in this class (164) as are sand (only) mold adjuncts (such as a metal chill).

Classes 264 and 425 provide for processes and apparatus respectively for metal shaping by liquid or melt comminuting. In this operation no mold is employed by the particles are shaped by the cohesive nature of the material, e.g., solidifying of a molten metal to a round ball while in free fall.

Molding processes and apparatus for metal powders are found in Class 419 (processes with sintering), Class 264 (compacting processes), and Class 425 (particle compositioning apparatus). In these powder metallurgical operations, the particles retain their identity as particles in the product. If they were completely fused, such operations would be provided for in this class (164).

Processes and apparatus for deforming metal are provided for elsewhere. (See References to Other Classes, below.)

Processes and apparatus for casting metal to form either single type or type-bars that are adapted to be set up as a printing form are provided for elsewhere. This class (164) provides for processes and apparatus for casting stereotype plates. (See References to Other Classes, below)

Processes of casting and molding material wherein a semiconductor junction device or material is produced by claim or disclosure are provided for elsewhere. (See References to Other Classes, below.)

## 3. Nonmetallic Materials

Class 249, Static Molds, provides for static molds for the general process of molding nonmetallic materials of Class 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, while Class 425, provides for the dynamic molding apparatus. A claim or, if not claimed, a disclosure of molding either metals or nonmetals will be classified in the nonmetallic class. A combination of a nonmetallic operation followed by an operation of this class (164) will be found in this class (164). An operation of this class (164) followed by an operation of a nonmetallic shaping class will be found in the nonmetallic shaping class, i.e., Classes 264 and 425.

Class 65 provides generally for processes of molding

glass. A patent disclosing working of named materials for this class (164) and Class 65 is classified in this class (164) unless the only species claimed is glass or the only specific example relates to glass in which case the patent is classified in Class 65. Combined processes including metal casting and glass working and/or treating are classified in this class (164).

## B. COMPOSITION CLASSES

For placement of patents reciting a mold by name only see Molding Process and Apparatus Classes, Molds Without Structure, above.

### 1. Metallic

Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, provides for a process of refining combined with a Class 164 process (significant or nominal). Class 420, Alloys or Metallic Compositions, provides for a process of alloying followed by casting where the alloying or refining step is either (1) prior to or (2) subsequent to the casting operation, i.e., removed from mold. This class (164) provides for apparatus for alloying or refining combined with casting apparatus where the alloying or refining is performed prior to or during casting. The term metal is utilized throughout the class to encompass free metal alloy or intermetallic compound as designated in Classes 75 and 420.

The order of superiority among various metal, alloy, and metal stock areas and methods of manufacture involving them is as follows:

1. Class 419, Powder Metallurgy Processes.
2. Class 148, Metal Treatment, subclasses 22+, compositions for treatment of solid metal.
3. Class 75, Specialized Metallurgical Processes, Compositions for Use therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 300, 301, and 303+, gaseous, liquid, or solid treating compositions for liquid metal or charges, and subclass 302, welding rod defined by composition.
4. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+, consolidated metal powder compositions and subclasses 255+, loose metal particulate mixtures.

5. Class 420, Alloys or Metallic Compositions, claimed as products.

6. Class 148, Metal Treatment, subclasses 95-122, 194-287, and 500-714, in class schedule order, providing for certain processes of treating solid or semi-solid metal by modifying or maintaining internal physical structure (i.e., microstructure) or chemical properties of metal, processes of reactive coating of metal or processes of chemical-heat removing (e.g., flame-cutting, etc.) or burning of metal. However, if metal casting, fusion bonding, machining, or working is involved, there is a requirement of significant heat treatment as described in the Class 148 class definition.

7. Class 148, Metal Treatment, subclasses 33+ barrier layer stock material and subclasses 400+, stock.

8. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 331+, processes of making solid particulate alloys directly from liquid metal and subclasses 343+, processes of producing purifying alloys in powder form.

9. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 10.1+ and 10.67, processes of making alloys by electrothermic, electromagnetic, or electrostatic processes.

10. Class 420, Alloys or Metallic Compositions, processes of manufacture.

11. Class 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 330+, processes of making metal and processes of treating liquid metals and liquid alloys and consolidating metalliferous material.

12. Class 204, Chemistry: Electrical and Wave Energy, processes.

13. Class 164, Metal Founding, subclasses 1+, processes.

14. Class 266, Metallurgical Apparatus, subclasses 44+, processes of operating metallurgical apparatus.

This list is not complete and may be added to as the proper relationship of other areas is determined.

## 2. Nonmetallic

This class (164) provides for a process of shaping, per se, of a mold, pattern or core device which is to be utilized in a metal casting operation, where there are significant shaping steps recited. The line with the various chemical composition classes and this class (164) is the same generally as that set forth in Class 264, Lines With Other Classes and Within This Class, Chemical Composition Classes. Clarification as to some of the technology peculiar to this class and any departures from the line set forth in Class 264 will be set forth below.

These lines are generally applicable where there is a mixing or blending of the mold, pattern or core composition recited to take place prior to the mold-step or a chemical reaction during the molding step. Where there is no claimed disclosure as to a chemical reaction, mixing or blending the patent is classified in this class even when only nominal shaping is recited.

Unless otherwise provided for, the recitation in a claim of a significant molding or shaping step will bring a patent to this class. Significant molding operations include named shaping by compaction, centrifugal force, spraying or slinging material against a shaping surface, or extruding of mold materials to form a shaping surface, and combinations of two or more broad molding or shaping steps and other combinations as set forth in Class 264.

Patents reciting physical or mechanical treatment subsequent to a broad molding step, e.g., shaping or molding broadly plus cutting or removing of excess mold material or heating subsequent to removal of a shaped article from forming surface to complete the cure will be placed in this class. Mere stripping alone or nominal return to ambient temperature is not considered to be an after treatment or a subsequent treatment within the scope outlined above.

## C. COMPOSITE ARTICLE FORMING CLASSES

### 1. Coating

The distinction between coating a metal onto a base for Class 118 or Class 427 and casting a metal onto the base for this class is predicated upon the presence of confining means for the molten metal as it solidifies on the base. If the melt is confined in all directions on the base against the force of gravity it is considered a process or apparatus appropriate for this class. The confin-

ing means may be structural dams, previously solidified casting material, or part of the base itself.

Also, if a metal layer is formed in a mold and another layer coated on the initial layer while it is still in a mold the operation is considered molding of plural layers for this class rather than coating since the operation takes place in a mold.

### 2. Fusion Bonding

This class (164) provides for a process and apparatus for joining two or more preforms or portions of the same preform, where (a) a removable mold member is used and (b) the molten metallic material is confined in all directions against the force of gravity (hole filling is considered a joining of portions). Fusion bonding therefore, not meeting the above limitation, is classified elsewhere. Processes and apparatus for bonding or welding by means of electric heating are also provided for elsewhere. (See References to Other Classes, below.)

## SEARCH NOTES

Only a limited amount of cross-referencing and cross-noting has been done between process and apparatus subclasses where the subject matter provides for is of comparable scope. One is cautioned therefore, to utilize both the process and apparatus sections of the schedule when determining fields of search.

## SECTION III - SUBCLASS REFERENCES TO THE CURRENT CLASS

### SEE OR SEARCH THIS CLASS, SUBCLASS:

- 349+, for mold made of sand or a similar particulate material.
- 374+, for flasks.
- 394+, for mold jackets.
- 397+, for core supporting devices, e.g., chaplets.
- 401+, for strippers.

## SECTION IV - REFERENCES TO OTHER CLASSES

### SEE OR SEARCH CLASS:

- 15, Brushing, Scrubbing, and General Cleaning, appropriate subclasses for apparatus for freeing casting of residual sand, especially subclass 94 and 304.

- 29, Metal Working, appropriate subclasses, especially subclasses 527.1+ for processes involving casting and additional treatment of the casting after it is removed from the mold. This class (164) provides for operation of preparing, e.g., coating, cutting, shaping by deforming, etc., a preform for a casting operation where the preform is the casting metal or a part of a final composite product, or removing a portion of the preform after the casting operation where the removal was to perfect the casting operation, e.g., position preform during compositing. See also Class 29, subclasses 526.2+ for processes of separation or localization of as-cast defects in ingots (e.g., anti-pipe). Also, see Lines With Other Classes and Within This Class, A, Molding Process and Apparatus Classes and C, Composite Article Forming Classes, *supra*.
- 34, Drying and Gas or Vapor Contact With Solids, appropriate subclasses for, per se, drying of a formed mold, and especially subclass 437 for processes of treating hollow articles or articles held in or on forms.
- 53, Package Making, subclass 423 for packing operations including the step of confining a fluid material so as to form a closure seal by solidification.
- 59, Chain, Staple, and Horseshoe Making, appropriate subclasses for processes and apparatus for making chains in which some manufacturing operation more than casting and joining is involved.
- 65, Glass Manufacturing, provides generally for processes of molding glass. (See Lines With Other Classes and Within This Class, A, Molding Process And Apparatus Classes, above.)
- 72, Metal Deforming, for processes and apparatus for deforming metal. The metal is in a self-sustaining conditioning during the formation. It may be "plastic" but it is not liquid (i.e., seeks its own level under the force of gravity). subclasses 253.1+ provides for forming by extruding through an orifice. The metal stock may be supplied to the feed chamber in the form of a liquid as a convenient way of handling a charge, but the charge must be solidified before it is forced through a die for placement in Class 72. (See Lines With Other Classes and Within This Class, A, Molding Process and Apparatus Classes, above.)
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+ for metal stock, blanks, or indeterminate articles. (Lines With Other Classes and Within This Class, Molding Process and Apparatus Classes, above.)
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses depending upon the metal produced for combined processes involving refining operations where not performed in the mold or while teeming into mold. See Lines With Other Classes and Within This Class, Molding Process and Apparatus Classes and see Metallic, *supra*.
- 100, Presses, appropriate subclasses for apparatus for pressing particulate material.
- 106, Compositions: Coating or Plastic, subclasses 38.2+ for compositions which are (a) specialized for use in making molds, (b) specialized for use in coating molds, or, (c) molds claimed solely in terms of the composition of which they are composed. Also, see Lines With Other Classes and Within This Class, A, Molding Process and Apparatus Classes, and B, Composition Classes, *supra*.
- 118, Coating Apparatus, appropriate subclasses for apparatus for coating molds where no more of the casting apparatus is claimed than is necessary to present the mold to the coating device or station. Also, see Lines With Other Classes and Within This Class, Composite Article Forming Classes, *supra*.
- 134, Cleaning and Liquid Contact With Solids, appropriate subclasses for methods of freeing castings of residual sand only, where the cleaning is effected by contact with a liquid. See subclasses 22 through 24 for processes of cleaning the internal surfaces of hollow work and subclasses 166+ for corresponding apparatus.
- 140, Wireworking, for process and apparatus for making wire containing products in which some wireworking operation more than composite casing or joining is involved.
- 148, Metal Treatment, particularly subclasses 538+ for combined processes of casting and significant heat treatment after removal from the mold or shaping surface to modify or maintain the internal physical structure (i.e., microstructure) or chemical property of metal. See the Class 148 Class Definition to determine what constitutes significant heat treatment. In

- continuous casting operations, wherein the contiguous product is still connected to the casting surface, a step involving significant heat treatment of the solid or semi-solid metal which occurs outside or away from the molding surface goes to Class 148. However, chemical heat removing (e.g., flame-cutting, etc.) or burning (i.e., oxidation) of a continuously cast metal goes to Class 164, if some of the continuously cast and contiguous product is connected to the shaping surface. Cutting operations, in the mold, goes to Class 164. See, particularly Class 148, subclasses 194+ for processes of chemical-heat removing (e.g., flame cutting) or burning (i.e., oxidizing) of metal; subclasses 100+ for combined processes involving casting followed by intentional alteration of the magnetic properties of the casting after removal from the mold.
- 163, Needle and Pin Making, for processes and apparatus for making needles and pins in which some manufacturing operation more than metal casting is involved.
- 199, Type Casting, for processes and apparatus for casting metal to form either single type or type-bars that are adapted to be set up as a printing form. This class (164) provides for processes and apparatus for casting stereotype plates. (See Lines With Other Classes and Within This Class, A, Molding Process and Apparatus Classes, above.)
- 219, Electric Heating, for processes and apparatus for bonding and welding by means of electric heating.
- 222, Dispensing, appropriate subclasses for ladles, crucibles, or other metal containers having dispensing structure such as a pouring lip or spout.
- 228, Metal Fusion Bonding, for fusion bonding.
- 241, Solid Material Comminution or Disintegration, appropriate subclasses for processes and apparatus for disintegrating a mold or core not associated with a flask or casting.
- 249, Static Molds, see Lines With Other Classes and Within This Class, Molding Process and Apparatus Classes, supra.
- 252, Compositions, see Lines With Other Classes and Within This Class, Molding Process and Apparatus Classes, supra.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, appropriate subclasses for similar processes of molding and shaping non-metallic materials especially subclasses 219+ for processes of mold making. See Class Definition, Amplified Statement Of Class Subject Matter, supra., and Lines With Other Classes and Within This Class, Molding Process and Apparatus, and Composition Classes, supra.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, for process for forming metal by a shot tower. (See Class Definition, Amplified Statement Of Class Subject Matter, supra.)
- 266, Metallurgical Apparatus, appropriate subclasses for apparatus adapted for the treatment of metals particularly subclasses 168+ for apparatus for melting or otherwise treating molten metal and subclasses 275+ for molten metal receptacles.
- 269, Work Holders, appropriate subclasses, particularly subclasses 86+ for a clamp means, per se, even if a mold or flask is named as the article held.
- 373, Industrial Electric Heating Furnaces, appropriate subclasses for electric furnaces such as arc, induction and resistance furnaces.
- 417, Pumps, appropriate subclasses for pumps, per se, for molten metal.
- 420, Alloys or Metallic Compositions, appropriate subclasses depending upon the metal value utilized for combined processes involving alloying operations where not performed in the mold or while teeming into the mold. Also, see Lines With Other Classes and Within This Class, Molding Process And Apparatus Classes, and Composition Classes, supra.
- 423, Chemistry of Inorganic Compounds, See Lines With Other Classes and Within This Class, A, Molding Process and Apparatus, supra.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, see Lines With Other Classes and Within This Class, A, Molding Process and Apparatus Classes, above.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, for apparatus for forming metal by a shot tower. (See Class Definition, Amplified Statement Of Class Subject Matter, supra.)
- 427, Coating Processes, subclasses 133+ for a process of coating a mold.
- 428, Stock Material or Miscellaneous Articles, subclasses 411+ and 615+ for nonmetallic and metallic composites, respectively, defined in terms of the composition of its components. (Lines With Other Classes and Within This Class, A, Molding Process and Apparatus Classes, above.)

- 433, Dentistry, appropriate subclasses for methods and apparatus which effect specific dental steps (e.g., taking impressions of teeth, trial filling, etc.).
- 438, Semiconductor Device Manufacturing: Process, for processes of casting and molding material wherein a semiconductor junction device or material is produced by claim or disclosure. (See Lines With Other Classes and Within This Class, A, Molding Process And Apparatus Classes, above.)
- 451, Abrading, for a method or apparatus for disintegrating a sand mold or for cleaning a casting by an abrading operation.
- 520, Synthetic Resins or Natural Rubbers. (See Lines With Other Classes and Within This Class, A, Molding Process And Apparatus Classes, above.)

## SECTION V - GLOSSARY

### ADDITION AGENT

In founding, any material, including principal alloying constituents, densifiers, fluidizers, graphitizers, grain size controllers, etc., added to the molten metal to produce specific effects in the solid metal.

### CAPPING

Intentionally stopping the rimming action in steel after completion of teeming.

### CARBURIZING (CARBONIZING)

Introducing carbon into ferrometals by heating above the transformation temperature range while in contact with carbonaceous material that may be solid, liquid, or gaseous.

### CASTING

The formation of an article by pouring or forcing molten metal into a mold or die and permitting it to solidify.

### CHAPLET

A device for holding a core in place.

### CHEEK

The intermediate part of a flask or mold that has more than two parts.

### CHILL

A piece of metal applied to the casting to hasten the solidification in that area.

### CONTINUOUS CASTING

Process of forming a product of indeterminate length wherein a portion of the product is removed from a forming mold or surface as a further contiguous portion is cast.

### CONTINUOUS CASTING STRAND

Semi-solidified product of a continuous casting process or apparatus comprising a generally molten center contained within a cooler solidified shell.

### COPE

The upper or topmost section of a flask, mold, or pattern.

### CORE

A separable part of a mold that is used to create openings and various shaped cavities in the casting.

### CORE BOX

A box or container in which foundry cores are made.

### CORE PRINT

A special projection on a pattern for forming impressions or core seats in the mold into which the core itself is inserted. Also refers to the projection on the core itself which fits into the core seat.

### DRAFT

The taper that is provided on otherwise vertical faces of a pattern to facilitate its removal from the sand mold.

### DRAG

The lower or bottom section of a flask, mold, or pattern. Also referred to as nowel.

### DRAW BAR

A bar used for lifting the pattern from the sand of the mold.

**DROSS**

The scum that forms on the surface of molten metals.

**FLASH**

A thin film of metal formed on a casting where the metal has flowed between mating parts of the mold.

**FLASK**

A box, usually of metal or wood, used to hold sand in which a mold is formed.

**FLUX**

(1) A substance that, by chemical action, promotes fusion of a solid material.

(2) A material capable of forming with gangue or other earthy matter, a liquid melt having the fusibility and chemical characteristics suitable to a specific furnace process. Also, protective flux to retard undesirable reactions.

**GAGGER**

A piece of metal used to support sand in deep pockets of sand molds.

**GATE**

The end of the runner where the molten metal enters the mold.

**HOT-TOP**

An insulated portion of a mold that retains metal molten in that area so that it can feed into the mold and alleviate shrinkage voids.

**INCLUSIONS**

Particles of dirt, slag or other impurities occurring in metals that were mechanically entrapped during solidification.

**INGOT**

An open-mold casting that is intended for remelting and recasting or reworking to form finished products. Also referred to as billet.

**INGOT MOLD**

A heavy mold, usually of cast iron, into which molten metal is teemed, as in the casting of ingots.

**INVESTMENT PATTERN**

A pattern of a material having a low melting point for use in processes employing special techniques such as precision casting where pattern withdrawal would be difficult.

**MATCH PLATE PATTERN**

A pattern plate with several patterns secured thereto or a plate having matching pattern portions mounted on opposite sides.

**MELT**

Metal that has been melted in preparation for casting.

**NOWEL**

See Drag.

**PATTERN**

A replica of an object to be cast and around which the mold is constructed.

**PATTERN PLATE**

A board to which patterns are to be attached and which extends substantially over the flask opening.

**PIPE**

A cavity formed in metal during the solidification of the last portion of liquid metal, causing by contraction.

**PREFORMED PRODUCT PART**

A self-sustaining body which is to be incorporated in the final product as a distinct part of the same (e.g., insert, etc.).

**RAMMING**

The operation of compacting sand into a sand mold and around a pattern.

**RISER**



A reservoir of molten metal provided for feeding into a casting as the metal in the mold solidifies thus preventing voids.

#### SAND MOLD

A mold made of sand and used for the making of sand castings. A green sand mold is a mold used as made without any drying operations and contains the original moisture of the mix.

#### SAND TEMPERING

Adding moisture to molding sand to make it workable.

#### SCAVENGER

A chemically active material added to molten metal to remove oxides, gases, or other impurities.

#### SEGREGATION

The occurrence of impurities, inclusions, and alloying constituents in nonuniform distribution.

#### SHELL MOLDING

A casting process utilizing a thin shell composed of resin-bonded sand for the cope and drag section of the mold.

#### SINGLE CRYSTAL

A metallic mass that consists of a single crystallographic grain instead of the usual polycrystalline material.

#### SLAG

The nonmetallic product of refining metal ores which results from the reaction of the flux with gangue.

#### SPRUE

Gates and risers of a mold assembly; the hole through which molten metal enters the mold; also, the waste portion attached to the product.

#### STOOL

The separable base of an ingot mold. The base provides a surface onto which the mold is placed, and also serves as the bottom of the mold.

#### SWEEP

A small section of a regular pattern which is generally rotated in sand to provide the whole mold cavity.

#### TEEMING

Pouring metal into a mold.

#### VENT

Small opening in a mold to allow trapped air to escape.

#### SUBCLASSES

**1** This subclass is indented under the class definition. Methods .

- (1) Note. Many of these subclasses have corresponding apparatus subclasses, therefore, a complete search may involve apparatus subclasses, which subclasses start at subclass 139 and continue to end of the class.

**2** This subclass is indented under subclass 1. Process directed to forming a surface capable of conveying intelligence or a design by reproducing in printed form.

- (1) Note. Included herein is the combination of forming the mat or matrix and casting of metal thereagainst to form a plate.
- (2) Note. The step of applying a backup member to a preformed printing plate is not considered forming a printing plate to be incorporated herein. This operation is found in the composite article forming area, i.e., subclasses 91+.

SEE OR SEARCH THIS CLASS, SUBCLASS:

91+, for processes of producing composite printing plates by casting backup metal to a preformed printing surface.

SEE OR SEARCH CLASS:

29, Metal Working, subclass 21 for processes of finishing (cutting, grooving, etc.) stereotype plates.

- 199, Type Casting, for processes of casting elements or bars of a printing form.
- 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 69 for processes of electroforming printing plates.
- 249, Static Molds, for static stereotype molds, particularly subclass 138 for pivotable type stereotype molds.
- 409, Gear Cutting, Milling, or Planing, subclass 309 for a planing operation performed on a concave surface such as a stereotype plate.
- 3** This subclass is indented under subclass 2. Process wherein a dynamic pressure, e.g., vacuum, pneumatic, hydraulic, etc., is directly applied to a molten metal to shape the same.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 61+, for processes of vacuum forming.
- 113+, for pressure casting of articles in general.
- 4.1 With measuring, testing, inspecting, or condition determination:**
- This subclass is indented under subclass 1. Process which includes the step of visually, audibly, or chemically testing, sampling, or inspecting, or otherwise physically or mechanically determining some variable condition in a cast article, molding material, mold structure, or casting surface.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 150.1+, for metal casting apparatus provided with inspection means.
- SEE OR SEARCH CLASS:
- 29, Metal Working, subclasses 407.01+ for processes of testing or indicating in a mechanical manufacturing operation.
- 65, Glass Manufacturing, subclasses 29.1+ and 29.12+ for processes of testing, inspecting, measuring, or condition determination in a glass forming or molding operation.
- 73, Measuring and Testing, appropriate subclasses for measuring or testing operations, per se.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 40.1 for processes of measuring, testing or inspecting in a plastic molding operation.
- 324, Electricity: Measuring and Testing, appropriate subclasses, for processes of electrical measuring and testing.
- 374, Thermal Measuring and Testing, appropriate subclasses for measuring or testing of a thermal quantity, per se.
- 436, Chemistry: Analytical and Immunological Testing, for processes of chemical testing.
- 5** This subclass is indented under subclass 1. Process in which excess material in the form of flash, trim, rejected products or used mold materials resulting from an intermittent or continuous process or treating materials therefor, are recycled or reused in the molding operation with or without purification, reclamation or separation of the desired constituents from contaminants.
- (1) Note. To be placed herein, a patent must recite a recycling of material employed previously in the mold making or casting process.
- (2) Note. The use of scrap or worn materials employed in commerce are not considered to involve a recycling step.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 92.1, for processes of repairing or restoring articles for use.
- SEE OR SEARCH CLASS:
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 37.1+ for processes of recycling of reclaimed or purified process material utilized in a nonmetallic molding operation.
- 6** This subclass is indented under subclass 1. Process which includes the step of producing by shaping (1) a mold, pattern or core device either as a, per se, operation by a method

within the definition of this class or (2) in combination with a step of employing said mold or core device in the production of a cast product by a process classifiable in this class in which latter instance the mold or core device may be formed by methods provided elsewhere.

- (1) Note. Also included herein is the shaping of a mold to be used in nonmetal molding of fluent or flowable materials if such shaping is performed on fluent metallic material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 138, for casting processes employing particular shaping surface material.

SEE OR SEARCH CLASS:

- 106, Compositions: Coating or Plastic, subclasses 38.2+ for particular mold compositions.  
 144, Woodworking, subclasses 329+ for a method of wood shaping.  
 205, Electrolysis: Processes, Compositions Used Therein, and Methods of Preparing the Compositions, subclass 70 for processes of electroforming dies.  
 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 219+ for processes of mold forming including sand molds for nonmetallic shaping.

## 7.1 Utilizing a vacuum during shaping:

This subclass is indented under subclass 6. Process in which a less than ambient pressure is employed.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 61+, for processes of utilizing a vacuum in shaping metallic material.  
 160.1+, for casting apparatus provided with means to shape a forming surface in the form of a shielding film.

## 7.2 To apply consumable shielding film to shaping surface:

This subclass is indented under subclass 7.1. Process wherein an impervious consumable membrane is adhered onto a particulate shaping surface by a vacuum.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 160.2, for casting apparatus provided with means to apply film or suction directly to mold material with a shielding film.

- 8 This subclass is indented under subclass 6. Process wherein a destructible pattern formed of frozen mercury is utilized in the shaping operation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 34+, for processes of employing destructible patterns in general.

- 9 This subclass is indented under subclass 6. Process directed to (1) shaping the forming surface utilizing the material which is to be ultimately cast as the pattern or preform member, or (2) shaping the forming surface wherein a preform member which is to be integrated in the material to be cast as a final product is embedded in the mold material during the shaping or forming thereof.

- (1) Note. The product part in (2) above to be included herein must be one which is individually handled.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 23+, for a process of forming a composite plural part or multi-layered mold.  
 91+, for, per se, processes of embedding a preform member in the cast metal.  
 231, for core shaping apparatus with means for positioning a preform part which is to be incorporated in the final cast product.  
 236, for a pattern member with means for holding a preform part which is to be incorporated in the final cast product.  
 332+, for apparatus for shaping metallic material including means to position a preform part.

- 10 This subclass is indented under subclass 9. Process wherein plural preform bodies, i.e., final product part or material, are utilized in forming or included in the shaping member.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

108, for process of uniting plural preforms.

- 11** This subclass is indented under subclass 10. Process wherein the final product parts or materials are embedded in or held by a core member of the mold structure.

- 12** This subclass is indented under subclass 6. Process directed to fixing or hardening a formed shaping surface by (1) igniting and burning the mold surface prior to pouring the casting or (2) by forcibly directing an inert gaseous medium against the shaping surface.

(1) Note. The gaseous hardening agent to be included herein cannot chemically react with the mold materials.

(2) Note. The gaseous hardening agent must be under a positive pressure application to be included herein.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

16, for process of hardening a shaping surface by treating with a chemically reactive gas.

- 13** This subclass is indented under subclass 6. Process directed to shaping pattern which is or is intended to be attached to a pattern, board or plate.

(1) Note. Generally the plate or board upon which the pattern is attached or an integral part thereof substantially covers the open portion of a flask member.

- 14** This subclass is indented under subclass 6. Process directed to shaping a forming surface combined with the step of coating the so formed surface with a treating material for perfecting a subsequent casting operation.

(1) Note. The primary function of the coating provided for herein is for treating the casting surface to perfect the casting operation, e.g., release agent or lubricant to allow easy withdrawal of cast product, fluxing or wetting agent. If the main purpose of the coating is to retain or

shape the work during the casting operation and not merely to perfect the casting operation then the operation will be found in subclasses 23+.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

23+, for process of forming composite plural part or multi-layered mold and especially subclass 33 wherein a mold surface is lined with mold material which functions to shape or retain the molten material during the casting operation.

55.1+, for process of lining or coating a casting surface with a material which is to be alloyed with the molten casting material.

66.1+, for process of coating a casting surface with a material which produces an inert or reducing gaseous atmosphere upon teeming of the metal.

72+, for process of coating-treating a casting surface combined with casting.

91+, for process of lining a casting surface with a material which forms a composite layer or coating with the cast material.

138, for casting processes employing a particular mold coating.

473, for continuous casting processes incorporating an addition or agent in a melt system.

475, for continuous casting processes including an inert or reducing gas atmosphere step.

SEE OR SEARCH CLASS:

106, Compositions: Coating or Plastic, subclasses 38.22+ for compositions for coating and lining molds.

427, Coating Processes, subclasses 133+ for processes of mold coating, per se.

- 15** This subclass is indented under subclass 6. Process directed to shaping from a fluent material the forming surface which confines and controls the ultimate desired shape of the molten metal that is to be formed therein.

- 16** This subclass is indented under subclass 15. Process directed to perfecting the hardening of the forming surface of a mold structure by contacting the surface with a gaseous medium

which is chemically reactive with the mold material.

- 17** This subclass is indented under subclass 15. Process directed to mechanically removing material from the surface of a shaped mold structure.

(1) Note. Included herein is the step of mechanically sub-dividing the mold structure, i.e., dividing a mold structure into component parts.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

161+, for apparatus for cutting the final mold as well as for cutting or sweeping to form the mold.

- 18** This subclass is indented under subclass 15. Process directed to successively shaping a plurality of molds.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

167+, for apparatus for shaping sequential molds combined with casting means.

- 19** This subclass is indented under subclass 15. Process directed to applying the mold material, either in bulk, droplet (mist) or particulate form, by propelling the material through space under dynamic pressure against the shaping surface.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

46, for process of spraying liquid metallic material against a shaping surface to form a cast product.

- 20** This subclass is indented under subclass 19. Process directed to applying the solid mold material in particulate form to the shaping surface.

- 21** This subclass is indented under subclass 20. Process wherein the particulate mold material that is sprayed against the shaping surface contains a resin material.

(1) Note. This subclass generally includes shell type molding processes where the resin material functions as a binder.

(2) Note. See Class 520, Synthetic Resins or Natural Rubbers, for a resin or composition containing a resin.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

165+, for shell molding apparatus.

526+, for processes of utilizing resin containing mold materials generally.

- 22** This subclass is indented under subclass 20. Process directed to employing compressed air as a ram or piston to force sand from a cartridge or container in which the material is supplied in the shape of a compacted column or the like against the shaping surface.

(1) Note. The compressed air does not come into actual contact with the sand that is being forced against the shaping surface.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

20, for those patents in which a stream of compressed air leaves the machine chamber carrying with it sand which is aerated before and during the blowing process.

- 23** This subclass is indented under subclass 15. Process wherein different parts or layers of mold materials are integrated by a shaping or forming operation.

(1) Note. Included herein is the non treating type coating or lining of the mold structure and also the impregnation of the mold structure.

(2) Note. A lining which functions to retain the casting material is included herein.

(3) Note. The mere insertion of a reinforcing member in the mold material is not sufficient to bring the patent here.

(4) Note. If a flask is a mere container for the mold material and does not affect the final shaping structure, the patent will be provided elsewhere on other features.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 14, for processes of mold forming plus subsequent treating coating.  
 72+, where the coating merely perfects the casting operation but does not itself shape the material, e.g., lubricate.
- 24** This subclass is indented under subclass 23. Process in which the different portions or parts of the mold are successively shaped or formed on the same mold shaping member, e.g., pattern member.
- 27** This subclass is indented under subclass 23. Process in which at least two different separable portions or parts of the mold structure are shaped or formed.
- 28** This subclass is indented under subclass 27. Process directed to shaping plural separable parts which includes shaping a core member.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 228+, for, per se, apparatus for shaping cores.
- 29** This subclass is indented under subclass 27. Process directed to shaping cope and drag sections of the mold member.
- 30** This subclass is indented under subclass 23. Process in which a core is placed, disposed or sustained in fixed relation with the forming surface of the mold.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 137, for a process for assembling mold parts.  
 340, for apparatus, including a mold, with means to position a core.  
 370, for cores having integral aligning means.  
 397+, for core centering or supporting means, per se.
- 31** This subclass is indented under subclass 30. Process wherein a plurality of cores are utilized.
- 32** This subclass is indented under subclass 31. Process directed to process of shaping a mold wherein plural cores are maintained in spaced relationship within the mold cavity.
- 33** This subclass is indented under subclass 23. Process directed to forming a layer on the mold shaping surface which functions to shape or retain the molten material during the casting operation.
- (1) Note. Before placing a patent herein a determination must be made that the lining functions to shape or retain the molten cast material. Such guidelines as the thickness of the applied lining, whether or not there are means, i.e., stops or dams, for confining the lining material in the mold, whether or not there are significant shaping steps disclosed, e.g., compacting, permanency of the lining are to be considered in making the determination.
- (2) Note. The combination of shaping one layer of a multi-layered mold and separately forming after removal from the initial shaping member a lining on the preformed layer would be placed herein.
- (3) Note. Generally the patents found herein are those disclosing lining centrifugal mold flasks with mold materials.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
 14, for a process of shaping a forming surface combined with the step of coating the casting surface with a treating material.  
 55.1+, for a process of lining or coating a casting surface with a material which is to be alloyed with the molten casting material.  
 66.1+, for a process of coating a casting surface with a material which produces an inert or reducing gaseous atmosphere upon teeming the metal.  
 72+, for a process of coating-treating a casting surface combined with the step of casting.  
 91+, for a process of lining a casting surface with a material which forms a

- composite layer or coating with the cast material.
- 473, for continuous casting processes incorporating an addition or agent in a melt system.
- 475, for a continuous casting process with an inert or reducing gas atmosphere.
- 34** This subclass is indented under subclass 15. Process directed to extracting a destructable pattern from the mold structure by (1) a chemical change, e.g., burning, etc., (2) a physical change of state, e.g., liquefying, etc., or (3) by reducing a solid to a flowable granular material.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
246, for a destructible type pattern.
- SEE OR SEARCH CLASS:  
29, Metal Working, subclasses 423+, for processes employing transitory or temporary material or parts.  
249, Static Molds, subclasses 61+ for a static shaping surface having a destructible feature.  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 221 for processes of destroying a pattern to disassociate the same from a plastic shaping mold.
- 35** This subclass is indented under subclass 34. Process directed to withdrawing the pattern in the liquid state.
- 36** This subclass is indented under subclass 35. Process wherein a fluid medium is used to effect the liquid extraction of the pattern.
- (1) Note. The fluid medium used herein would include any solvent fluid, e.g., steam, hot water, etc.
- 37** This subclass is indented under subclass 15. Process directed to the step of actively pressing or packing the mold materials against a mold shaping surface to form a densified structure.
- (1) Note. The pressing or packing force must be greater than the force of gravity.
- SEE OR SEARCH CLASS:  
100, Presses, subclasses 35+ for process of compressing miscellaneous materials.
- 38** This subclass is indented under subclass 37. Process directed to applying two or more pressure forces which are different in kind upon the mold material to densify the same.
- 39** This subclass is indented under subclass 37. Process wherein the active pressing or packing is effected by jarring the mold structure with a sudden blow or blows or by oscillating the structure.
- 40** This subclass is indented under subclass 37. Process directed to shaping a forming surface by compacting the mold material against a shaping member, e.g., pattern, wherein the shaping member is utilized as the primary force applying member.
- (1) Note. Patents directed to forming a hollow mold structure by exerting radial pressure to the mold material are included herein.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
187+, for apparatus wherein the pattern member acts as the pressing member and including drawing means.
- 44** This subclass is indented under subclass 15. Process directed to the extracting of patterns from a mold by a mechanical process.
- (1) Note. Stripping by name alone does not place a patent here.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
34+, for processes of removing a pattern by destruction.
- 45** This subclass is indented under subclass 6. Process directed to forming patterns by shaping plastic mold materials.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
9+, for processes of utilizing the final product material as a pattern.

- 13, for processes of shaping a plate-type pattern.
- 46** This subclass is indented under subclass 1. Process wherein a shaped body of metallic material is produced by effecting a deposition of a gas, vapor or projected comminuted melted material, e.g., spray, etc., on a shaping surface.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 19, for process of spray-shaping a forming surface from molten material.
- SEE OR SEARCH CLASS:
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 5+ for the process of comminuting a liquid material (including metal) to form discrete solid particles, and subclass 309 for spraying or flinging plastic material against a shaping surface.
- 47** This subclass is indented under subclass 1. Process which includes the step of shaping molten metal by means of a molding surface.
- (1) Note. Metallic material to be incorporated herein must be a pure metal alloy, metallic composition, or intermetallic compound. See the class definition of Class 420, Alloys or Metallic Compositions, for the general definition of the terms alloy, or metallic composition as used herein.
- 48** This subclass is indented under subclass 47. Process wherein an energy quantity is applied directly to the work material as (1) an electromagnetic wave which is included in the frequency spectrum including and above audio frequency range (i.e., 50 cps), (2) an electric field or force or (3) an explosive force.
- (1) Note. Included are such electromagnetic waves as radio, infrared, light, ultraviolet and gamma rays.
- (2) Note. Application of sonic and supersonic wave energy are included herein. The mere application of vibratory or oscillatory forces without effecting
- transmission of wave energy, e.g., subsonic, are provided for below on other features.
- (3) Note. For radiant energy to be included herein, it must be specifically claimed.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 39, for process of compacting mold materials by oscillating or vibrating.
- 71.1, for process of chemically treating cast material by vibrating.
- 478, for continuous or semi-continuous casting processes wherein the mold is vibrated or reciprocated.
- SEE OR SEARCH CLASS:
- 204, Chemistry, Electrical and Wave Energy, generally for processes in which a chemical change is effected by means of electrical or wave energy.
- 205, Electrolysis: Processes, Compositions Used Therein and Methods of Preparing the Compositions, for electrolytic treatment.
- 250, Radiant Energy, subclasses 324+ for methods and apparatus devoted to the corona irradiation of material, subclasses 432+ for methods and apparatus for irradiating contained, supported or transferred fluent material, subclasses 453.11+ for methods and apparatus including supports for irradiated objects with or without the irradiating source and subclasses 492.1+ for methods and apparatus to irradiate objects or material.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 405+ for processes involving the use of electrical or wave energy in plastic molding operations; subclass 84 for process of applying an explosive force to make a nonmetallic article.
- 53** This subclass is indented under subclass 47. Process wherein a chemically reactive material is employed in or on the body of casting material itself to raise or maintain the temperature thereof.



- (1) Note. Applying an open flame to the casting material is not considered a chemical reaction for this subclass.
- (2) Note. The reactive heating does not have to be in the mold cavity but may be in some portion of the mold body.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 123, for processes of applying an insulation to a melt surface to control solidification.
- 124, for processes of directly applying a flame or gas to the melt surface to control solidification.

**SEE OR SEARCH CLASS:**

- 44, Fuel and Related Compositions, subclasses 250+, for a fuel composition intended to generate heat without light.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclass 959 for processes of thermite type reduction-treating of metals.
- 149, Explosive and Thermic Compositions or Charges, subclasses 37+, for metal containing thermic compositions.

- 54** This subclass is indented under subclass 53. Process wherein an exothermic chemical reaction in the proximity of a metal body in solid state reduces the metal to a liquid in an area of composition to effect a joining.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 91+, for processes of compositing in general.

**SEE OR SEARCH CLASS:**

- 228, Metal Fusion Bonding, appropriate subclasses for formation of a metallic bonded joint between parts or portions of the same part. Molten filler material may be confined or retained by the shape or space between the parts so long as a mold device is not employed.

**55.1 Incorporating addition or chemically reactive agent to metal casting material:**

This subclass is indented under subclass 47. Process wherein a material is directly added to a melt system to (a) either become incorporated therein physically, e.g., alloying, or (b) cause a chemical reaction to affect the metallic system.

- (1) Note. The added material may include principal alloying constituent, densifiers, fluidizers, chemical graphitizers scavengers, grain-size controller, etc.

**SEE OR SEARCH CLASS:**

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for processes for producing metals.
- 423, Chemistry of Inorganic Compounds, subclasses 1+ for processes of chemically treating mixtures to obtain metal containing compounds.

**56.1 To scavenge:**

This subclass is indented under subclass 55.1. Process directed to adding a chemically active, e.g., scavenger, material to the metallic casting material to remove oxides, gases, or other impurities therefrom.

**SEE OR SEARCH CLASS:**

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for processes of treating molten metal to remove unwanted components therefrom.
- 423, Chemistry of Inorganic Compounds, subclasses 1+ for processes of chemically treating mixtures to obtain metal-containing compounds.

**57.1 Adding metal-containing material:**

This subclass is indented under subclass 55.1. Process directed to adding a metal-containing material to the metallic casting material.

- (1) Note. The metal material may be in the form of a free metal, alloy, compound, or composition.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 270.1, for apparatus of this class combined with alloying means.

SEE OR SEARCH CLASS:

- 420, Alloys or Metallic Compositions, appropriate subclasses for alloying processes. In Class 420, an alloying processes is classified with the composition of the specific alloy made. Subclasses drawn to processes of making alloys are: 18+, processes of adding magnesium to cast iron; 29+, processes of making cast iron; 71, processes of making over 9 percent chromium steel, e.g., stainless steel; 84+, processes of adding lead, bismuth, selenium, tellurium or calcium to ferrous alloys, usually to improve machineability; 115+, processes of making low chromium steel; 129, general processes of making ferrous alloys; 590, general processes of making alloys.

#### **58.1 To produce casting having nonhomogeneous composition:**

This subclass is indented under subclass 57.1. Process wherein the addition of the metal-containing material to the metallic-casting material produces a casting having a nonuniform composition.

- (1) Note. To be placed herein, the patent must disclose that a nonhomogeneous casting is produced. A casting having a varying alloy composition across a given cross section comes within the scope of this subclass.

SEE OR SEARCH CLASS:

- 148, Metal Treatment, subclasses 400+ for metallic stock material produced by a method of this subclass (Class 164, subclass 58.1).

#### **59.1 Utilizing preform body:**

This subclass is indented under subclass 58.1. Process directed to casting upon a preform body which remains a part of the casting product.

- (1) Note. To be placed herein, the preform must retain its identity in the cast product.
- (2) Note. A mere coating of the mold surface is not considered a preform body.
- (3) Note. Plural preform bodies to be encompassed herein must be individually handled.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 75, for coating a preform to provide a bonding-alloying layer with subsequently cast metal.
- 91+, for composite article formation.

- 61** This subclass is indented under subclass 47. Process directed to exhausting or partially exhausting air or other gases from the environment of the casting material, before, during or after casting by applying a pressure differential directly to the material.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 7.1, for processes of applying a vacuum in a mold forming operation.

SEE OR SEARCH CLASS:

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for vacuum treatment of metals.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 500+ for processes of vacuum forming plastic materials, and subclasses 101+ for processes of vacuum treating work.

**62** This subclass is indented under subclass 61. Process directed to applying, in addition to the differential in pressure effected by the vacuum, a dynamic pressure medium.

**63** This subclass is indented under subclass 61. Process wherein the pressure differential created by the vacuum effects the transport of the casting material to the mold cavity thus effecting the shaping of the material.

- (1) Note. Included herein are those processes of applying a vacuum through a mold to obtain a more perfect reproduction.

**65** This subclass is indented under subclass 61. Process wherein a vacuum is present in the mold environment during the introduction of the casting material into the mold.

**66.1 Applying an inert or reducing gaseous atmosphere to work:**

This subclass is indented under subclass 47. Process wherein the work material is subjected to an inert or reducing gaseous environment either before, during, or after charging the casting material to a mold.

- (1) Note. An ambient atmosphere which may be inert is not included herein.

**SEE OR SEARCH CLASS:**

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, various subclasses for processes for gaseous treating of metal.  
148, Metal Treatment, subclasses 633+ or 712+ for combined processes of significant heat treatment of solid or semi-solid metal and treatment with a special gaseous composition.

**67.1 Atmosphere effected by chemical reaction:**  
This subclass is indented under subclass 66.1. Process wherein the inert or reducing atmosphere is effected by a chemical reaction involving the casting material or is initiated by the introduction of a reactive material into the mold environment.

**68.1 While melting casting material:**

This subclass is indented under subclass 66.1. Process wherein the casting material is rendered molten under the affect of a inert or reducing gaseous ambient.

**69.1 With step of subdividing or removing material from product or preform (e.g., cutting, mechanically or by heat, sandblasting, chemical milling, etc.):**

This subclass is indented under subclass 47. Process wherein (a) a portion of a preformed body or a body formed during the casting operation is removed, or (b) where a body is reduced into two or more parts.

- (1) Note. The body portion may be removed to reduce the size thereof or, as in the case of a preform, to perfect the bond between the preform and the metal cast, e.g., as in cutting to form interlocking means.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 101+, for process of picking or cleaning a preform prior to compositing.

**SEE OR SEARCH CLASS:**

- 29, Metal Working, subclass 21 and 24 for cutting or finishing printing members; and subclass 527.6 for casting combined with cutting or finishing after removal from the mold.  
83, Cutting, subclasses 13+ for processes of metal cutting.  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 138+ for process of shaping and subsequent cutting of plastic material.  
451, Abrading, subclasses 28+ for a process of abrading metal.

**70.1 With product trimming, cutting, or breaking prior to removal from mold:**

This subclass is indented under subclass 69.1. Process which includes the finishing of the casting by trimming, cutting, or breaking before removal from the mold or mold part.

- (1) Note. The term "mode" as used herein includes (a) the core or cores, (b) core-

like elements associated with gate portions of the casting and used for handling, and (c) conveying means serving to support a continuous casting while said casting is still associated with the mold.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 78, for processes of incorporating a product-dividing member during casting.
- 140, for apparatus to cast printing plates including means for cutting or trimming the casting.
- 161+, for apparatus for shaping a forming surface, e.g., mold, including cutting or sweeping means.

**SEE OR SEARCH CLASS:**

- 249, Static Molds, subclass 52 for static mold employing a static means to produce a groove or depression in the product to facilitate breaking or cutting.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 161 for flash or sprue removal in a plastic molding operation.

**71.1 With vibratory treatment of casting material:**

This subclass is indented under subclass 47. Process directed to vibrating the casting material to effect an internal change in the structure of the material, e.g., by removing gases, inclusions, or by refining the crystalline structure.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 39, for vibratory treatment of molding materials.
- 260+, for apparatus which includes a treating or nontreating operation.

**SEE OR SEARCH CLASS:**

- 148, Metal Treatment, subclass 558 for processes of treating solid or semi-solid metal outside the mold with high frequency vibration.

**72** This subclass is indented under subclass 47. Process which includes the step of applying a coating to the forming surface before the metal is introduced to the surface.

- (1) Note. A coating coming within the scope of this subclass is one which merely perfects the casting operation but does not itself shape the material, e.g., to lubricate.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 33, for process of forming a coating or lining on the mold shaping surface which functions to retain and shape the work during the casting operation.
- 57.1+, for processes including the coating of a mold surface with alloying material.
- 138, for particular materials utilized as mold coatings or linings.

**SEE OR SEARCH CLASS:**

- 106, Compositions: Coating or Plastic, subclasses 38.22+, for mold coating compositions.
- 249, Static Molds, subclass 114.1 for static molds including a coating or adherent layer.
- 427, Coating Processes, subclass 133 for processes of mold coating, per se.

**74** This subclass is indented under subclass 72. Process wherein the coating produces a gas during the casting operation.

- (1) Note. The gas may be produced by a chemical reaction, e.g., burning, decomposition, etc., or by vaporization.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 55.1+, for processes of incorporating gaseous constituents in the casting material.
- 66.1+, for processes of forming an inert or reducing gaseous atmosphere.
- 473, for continuous casting processes incorporating an addition or agent in a melt system.
- 475, for continuous casting processes with an inert or reducing gas atmosphere.

**75** This subclass is indented under subclass 47. Process in which a preformed base member has applied to it a coating to provide a layered product.

- (1) Note. The coating must remain as a product part or layer subsequent to the operation of this class to be included herein.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 100+, for preconditioning of a preform by a coating operation where the coating does not remain as part of the final product.

**SEE OR SEARCH CLASS:**

- 29, Metal Working, appropriate subclasses, especially subclass 527.3 for processes of casting with a subsequent coating step.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 134+ for processes of coating a workpiece before a nonmetallic molding operation.
- 427, Coating Processes, appropriate subclasses for coating processes, per se.

**76.1 Combined:**

This subclass is indented under subclass 47. Process which includes an operation which, by itself, is neither an operation of this class nor a perfecting step of an operation of this class.

**SEE OR SEARCH CLASS:**

- 29, Metal Working, subclasses 527.1+ for a combined casting and manufacturing process wherein the manufacturing step is performed after removing the cast product from the mold.
- 148, Metal Treatment, subclass 2 for combined casting, working and heat treatment operations.

**77**

This subclass is indented under subclass 47. Process wherein liquid metal is placed into a mold, a layer of metal is solidified on the mold surface, and the excess liquid is removed from the mold.

**SEE OR SEARCH CLASS:**

- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 302 for slush casting type processes for nonmetallic material.

**78**

This subclass is indented under subclass 47. Process wherein a unit is incorporated into the product during the metal casting which provides a fracture or division plane to subdivide the product.

**SEE OR SEARCH CLASS:**

- 249, Static Molds, subclass 52 for static molds employing a static means to produce a groove or depression in the product to facilitate breaking or cutting. Subclass 84 for static mold providing for a unitable preform which functions as a partition means.

**79**

This subclass is indented under subclass 47. Process wherein a substance is randomly incorporated into the metallic material to produce a porous product.

**SEE OR SEARCH CLASS:**

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclass 415 for processes of producing a metal product which has a mass of pores.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 41+ for processes of producing porous nonmetallic bodies.
- 419, Powder Metallurgy Processes, subclass 2 for processes for making porous articles from metal powders involving pressure and heat.
- 428, Stock Material or Miscellaneous Articles, subclass 613 for metallic stock which is porous.

**80**

This subclass is indented under subclass 47. Process wherein the metallic material is introduced into the shaping area in solid form.

- (1) Note. The solid metallic material may either be introduced initially into the mold or may be added to a molten charge already in the mold.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 57.1+, where an alloying material is added to the melt as a solid.

- 473, for continuous casting processes incorporating an addition or agent in a melt system.
- 495+, for processes of using a solid consumable electrode.
- 81** This subclass is indented under subclass 47. Process wherein the shaping surfaces is a molten or liquid layer.
- SEE OR SEARCH CLASS:
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 298 for casting nonmetallic material on a liquid surface.
- 90** This subclass is indented under subclass 47. Process wherein the product contains at least two distinct parts or portions which are movable relative to each other and which are joined by the shaping operation.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 9+, for process of forming a mold and incorporating a product part therein.
- SEE OR SEARCH CLASS:
- 29, Metal Working, subclasses 434+ for processes of assembling with retention of a clearance for motion between assembled parts.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 242 for similar operation when molding nonmetallic material.
- 428, Stock Material or Miscellaneous Articles, subclass 591 for metallic stock material having components capable of limited relative movement.
- 91** This subclass is indented under subclass 47. Process of making multi-layered articles by forming a metal onto a preform or casting two or more metals into contact with one another.
- (1) Note. A composite article must have at least two distinctive zones of metal of the same or different materials. If solids of the same metal or different metal are incorporated into cast molten metal and such lose their identity this is not a composite for this and indented subclasses.
- (2) Note. Included herein are those operations where two or more metal preforms are united by fusing a portion of the metal to provide a joint between them.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 9+, for process of shaping mold material wherein the product part is embedded in or surrounded by shaped material.
- 23+, for process of making composite, plural part or multi-layered mold.
- 55.1+, for processes of producing layer article by incorporating an addition or chemically reactive agent in the casting material.
- 461, for continuous or semicontinuous casting processes of forming a composite product.
- SEE OR SEARCH CLASS:
- 29, Metal Working, subclass 428 for processes of assembling or joining in mechanical manufacturing operations, and subclass 527.3 for casting and coating manufacturing steps.
- 65, Glass Manufacturing, subclasses 36+ for processes for fusion bonding of glass to a formed part.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 241+ for processes of producing composite, plural part or multi-layered articles wherein the molding material is nonmetal; however one or more parts, portions or components of the composite may be metal, e.g., process of uniting two spaced metal preforms is in subclass 261.
- 419, Powder Metallurgy Processes, subclasses 5+ for powder metallurgical processes with sintering for forming plural metallic layers or parts.
- 428, Stock Material or Miscellaneous Articles, subclasses 615+ for a metallic composite defined in terms of the composition of its components.
- 438, Semiconductor Device Manufacturing: Process, for producing semiconductor junction material even when using a Class 164 operation.

**92.1 Repairing or restoring articles for use:**

This subclass is indented under subclass 91. Process wherein a worn, damaged, or used article is restored for reuse in a similar capacity without altering or destroying the overall configuration of said article.

**SEE OR SEARCH CLASS:**

- 29, Metal Working, subclasses 402.01+ for processes of mechanical repair.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 36.1+ for processes of repairing or restoring nonmetallic articles for reuse by molding operations, especially subclass 36.18 for articles containing inorganic materials.

- 93** This subclass is indented under subclass 91. Process of forming a composite article wherein two or more different metals are poured into a mold simultaneously and wherein at least two of said metals are temporarily separated by a barrier means which is removed either physically or by melting same to allow said metals to come into contact.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 91, for processes of co-molding metals into direct contact.
- 99, for processes of co-molding metals and uniting to a preform.

**SEE OR SEARCH CLASS:**

- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 260 for co-molding plural fluent non-metal materials and uniting to preform.

- 94** This subclass is indented under subclass 91. Process of forming a composite article by sequentially casting molten metal.

- (1) Note. The sequentially cast molten metal(s) may be cast onto and in contact with the previously cast metal or may be separated from one another by some preformed portion, part or component of the composite article.

- (2) Note. The metals cast may be of the same or different materials; however, if the metals cast are the same material, the prior cast metal must be cooled and solidified, i.e., act as a preform, before the subsequent metal is cast.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 27, for processes of forming mold by separately molding different mold portions.
- 90, for processes of forming interconnected movable parts, e.g., chain links, universal joints, etc.

**SEE OR SEARCH CLASS:**

- 228, Metal Fusion Bonding, subclasses 225+ for a process involving at least two applications of filler material to effect a single joint. Successive depositions of filler material may involve deposition of successive strata one upon the other as well as successive depositions on opposite sides of the joint.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 250+ for processes of separately molding different article portions where the material molded is other than metal; subclass 308 for incremental layer molding of non-metal.

- 95** This subclass is indented under subclass 94. Process of forming composite article by casting two or more metals of different composition sequentially.

- 96** This subclass is indented under subclass 95. Process wherein at least two of the cast different metallic materials are maintained stratified although in a liquid condition.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 93, where simultaneously molten materials are also cast simultaneously.

- subclasses 62+ for similar processes not utilizing heat.
- 97** This subclass is indented under subclass 91. Process wherein the composite is formed by uniting plural nonindividually handled pieces with the molten metal.
- 98** This subclass is indented under subclass 91. Process wherein the composite article is formed by shaping the metal onto a self-sustaining body.
- 99** This subclass is indented under subclass 98. Process wherein two or more different metals are simultaneously introduced onto a shaping surface.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
93, for co-molding processes wherein a temporary partition is employed.
- 100** This subclass is indented under subclass 98. Process which includes a step of treating a preform body prior to compositing.
- (1) Note. A treatment step involves, e.g., cleaning the surface of the preform of foreign matter such as scale, oil, etc.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
75, for process of coating of a workpiece before compositing.
- SEE OR SEARCH CLASS:  
29, Metal Working, subclasses 458+ for processes of mechanically assembling and/or joining of previously coated parts.  
228, Metal Fusion Bonding, subclasses 208+ for metallurgical bonding combined with application of a bond facilitating metal coating.  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 265 for process of preconditioning of a preform in nonmetallic compositing operations.  
419, Powder Metallurgy Processes, subclasses 30+ for powder metallurgical processes for making products including sintering and also including significant pretreatment of the powder prior to compacting or sintering; and
- 101** This subclass is indented under subclass 100. Process of treating the surface of the preform with some chemically reactive agent.
- (1) Note. Although chemical treatment may result in the surface layer of the preform being chemically changed, such treatment does not involve a separate coating which acts as the bonding medium.
- 102** This subclass is indented under subclass 101. Process wherein the chemical treatment involves the application of a layer of flux.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
75, for a process of coating a preformed workpiece where the coating remains as a part of the final product.
- SEE OR SEARCH CLASS:  
148, Metal Treatment, subclasses 23+ for fluxing compositions.  
228, Metal Fusion Bonding, subclasses 223+ for a process utilizing flux materials in a noncasting metallurgical bonding operation.
- 103** This subclass is indented under subclass 100. Process of raising the temperature of the preform prior to casting the molten metal thereon.
- (1) Note. The preheating may be by open flame contacting the preform surface or by hot fluid.  
(2) Note. Preform may be heated directly on the bonding surface or a face opposite the bonding face.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
54, for a process of in situ reactive heating during formation of a composite.  
121, for a process of preconditioning of apparatus including preheating.  
338.1+, for means to apply heat to a mold.
- 104** This subclass is indented under subclass 103. Process wherein the preheating is accomplished by means of a heating material in the



- liquid state which contacts either the preform or the mold.
- (1) Note. Preheating of the preform by means of the cast material which makes up part of the product is included herein only if it is specifically claimed as such.
- 105** This subclass is indented under subclass 103. Process wherein the preform is positioned in a mold when preheated.
- (1) Note. Processes are included herein of heating a mold prior to casting wherein the preform is incidentally or purposely heated.
- 106** This subclass is indented under subclass 98. Process wherein the cast metal acts upon the preform to reshape it while maintaining the preform's integrity either by the casting pressure or by the forces set up during cooling.
- SEE OR SEARCH CLASS:  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 266 for simultaneous shaping of non-metallic material and reshaping a preform body.
- 107** This subclass is indented under subclass 98. Process wherein a preform is united to a cast metal to perfect the cast metal by treating rather than to provide a united article as such.
- (1) Note. By treating is meant a change in the physical or chemical properties of the cast metal.
- 108** This subclass is indented under subclass 98. Process of making a composite and unitary product by joining together a plurality of preforms or two spaced areas of the same preform with cast metal.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
9+, for mold shaping processes utilizing a final preform part or material as a part thereof.  
333, for apparatus to position plural preforms in a mold.
- SEE OR SEARCH CLASS:  
228, Metal Fusion Bonding, appropriate subclasses for uniting surfaces by a metallic filler without shaping of the filler by a molding surface.
- 109** This subclass is indented under subclass 108. Process of forming a composite article by joining together a plurality of planar laminar preforms positioned in substantially parallel planes to one another and at least partially coextensive.
- (1) Note. The preforms may be spaced from one another or in contact with one another.
- 110** This subclass is indented under subclass 108. Process wherein at least two separate preforms are united into contacting relation by the casting.
- 111** This subclass is indented under subclass 98. Process where the preform has depressions therein or projection therefrom which cause the molten metal to mechanically lock with the preform.
- SEE OR SEARCH CLASS:  
30, Cutlery, subclass 343 for cutlery implements in which the handle is cast onto the blade tang.  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 274 for processes of embedding a preform provided with means to provide an interlock with nonmetallic molding material.
- 112** This subclass is indented under subclass 98. Process of positioning the preform relative to a forming surface prior to casting.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
9+, for process of shaping a forming surface and embedding a product part therein  
231, for core shaping apparatus including means to position preform product part.  
236, for patterns having insert supporting means.

- 332, for apparatus including means to position a preform part in the shaping area.
- 113** This subclass is indented under subclass 47. Process wherein the material is forced against the shaping surface by a force other than gravity.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
48, for a process of applying explosive pressure directly to casting material.
- 114** This subclass is indented under subclass 113. Process wherein the material is impelled radially outwardly against the forming surface by rotation of the surface.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
175, for apparatus for centrifugally shaping a mold.
- SEE OR SEARCH CLASS:  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 311 for processes of utilizing centrifugal force in shaping nonmetallic material.
- 115** This subclass is indented under subclass 114. Process wherein two or more speeds of rotation are maintained during the centrifugal casting.
- (1) Note. Merely increasing or decreasing rotation to a desired speed is not considered plural speeds for this subclass.
- 116** This subclass is indented under subclass 114. Process wherein the angle of inclination of the axis of rotation is varied between the time of charging of the material and ejecting the product.
- 117** This subclass is indented under subclass 114. Process wherein the charge of material is introduced incrementally along the axis of the mold during rotation.
- 118** This subclass is indented under subclass 114. Process wherein the centrifugal mold has applied to it a thermal differential source.
- (1) Note. The source to be intended for inclusion herein must be other than ambient.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
122+, for processes in general of temperature control during solidification.
- 119** This subclass is indented under subclass 113. Process wherein the forming pressure is provided by a fluid acting directly on the casting material.
- (1) Note. The casting material itself is not included as a fluid within the meaning of this subclass.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
61+, for processes employing a vacuum.  
66.1+, for processes utilizing a special inert or reducing gaseous atmosphere.  
475, for continuous casting processes including an inert or reducing gas atmosphere.
- 120** This subclass is indented under subclass 113. Process wherein a compaction of the material is accomplished after the primary casting material is against the forming surface by a separate and distinct force from that used to introduce the material.
- 121** This subclass is indented under subclass 47. Process wherein the apparatus is treated or readied for casting.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
14, for processes of forming a mold and coating the surface with treating material.  
55.1+, for processes of incorporating an addition or chemically reactive material into casting material.  
72+, for processes of coating-treating a mold.  
149, for means lubricating apparatus parts.  
158, for apparatus cleaning means.  
473, for continuous casting processes including a step of incorporating an addition or agent in a melt system.

- 122** This subclass is indented under subclass 47. Process wherein the freezing of the metal is regulated.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 118, for processes of heating or cooling centrifugal molds.  
 297, for centrifugal casting apparatus having coolant means.  
 338.1+, for a mold with a heating means.  
 348, for a mold with a cooling means.  
 352, for a sand mold having a metal chill.  
 443+, for apparatus for cooling a continuous casting.  
 486, for processes of applying liquid to a continuous casting.

**SEE OR SEARCH CLASS:**

- 249, Static Molds, subclass 111 for static molds employing a solid heat conductor or insulator.

**122.1 Unidirectional solidification:**

This subclass is indented under subclass 122. Process wherein an unidirectional temperature gradient is established along a mold to cause progressive solidification of molten metal within the mold.

**SEE OR SEARCH CLASS:**

- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for processes for growing therein-defined single-crystal of all types of materials, other than metal single-crystal formed in a mold proper herein, however, metals, intermetallics, and alloys which are semiconductors are excluded herein and are proper for Class 117.

**122.2 Single crystal formation:**

This subclass is indented under subclass 122.1. Process which includes propagating a single crystallographic grain of metal within the mold.

**SEE OR SEARCH CLASS:**

- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for processes for growing therein-defined single-crystal of all types of materials, other than metal single-crystal formed in a mold proper herein, however, metals, intermetallics, and alloys which are semiconductors are excluded herein and are proper for Class 117.

- 123** This subclass is indented under subclass 122. Process wherein the regulation is effected by the addition of a separate layer of a heat barrier material to the free surface of the melt after casting.

- 124** This subclass is indented under subclass 122. Process wherein the regulation is effected by the application of a gas or flame to the cast material itself.

- 125** This subclass is indented under subclass 122. Process wherein the solidification is varyingly controlled by two or more simultaneous different rates of heat loss.

- 126** This subclass is indented under subclass 125. Process wherein the heat removal is effected by use of an applied liquid.

- 127** This subclass is indented under subclass 125. Process wherein the differential dissipation of heat is effected by means of an insert or mold section placed at the mold surface or embedded in the mold to provide a zone of greater heat absorption.

- 128** This subclass is indented under subclass 122. Process wherein the solidification and heat removal is effected by use of an applied liquid.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 126, for utilizing a cooling liquid to obtain a differential dissipation of heat.

- 129** This subclass is indented under subclass 47. Process wherein two or more separate and distinct articles are produced by the process.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
350, for a sand type mold having plural article forming cavities.
- 130** This subclass is indented under subclass 129. Process wherein the articles are produced one after the other.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
324, for apparatus including plural molds moving in an endless mold circuit.
- 131** This subclass is indented under subclass 47. Process wherein the produced product is separated from the surface of which it was shaped.
- (1) Note. Included herein are patents claiming, per se, stripping operation, i.e., not including a forming operation.
- (2) Note. Included herein are generally patents which include a unique article removal operation. Numerous patents which are directed to a particular casting operation will also disclose or claim a removal operation. Such patents are cross-referenced here only where the evidence shows the article removal operation to be nonconventional.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
344+, for a shaping apparatus having means to eject product.  
401+, for strippers or ejectors, per se.
- SEE OR SEARCH CLASS:  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 334+ for processes of stripping nonmetallic articles from molds.
- 132** This subclass is indented under subclass 131. Process wherein the surface is that of a separate mold part used to form an opening or cavity in the product, i.e., core.
- 133** This subclass is indented under subclass 47. Process wherein the material to be cast is handled with either a regulation or directionalization of the charge or a physical treatment of the charge.
- (1) Note. The mere teeming of metal into a mold is not included herein.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
335+, for shaping apparatus including ladle or crucible type receptacle.  
362, for a sand mold having means to restrict turbulence of flow during casting.  
437+, for continuous casting means having means to distribute the charge.
- 134** This subclass is indented under subclass 133. Process wherein the treatment results in a separation of some material from the charge, e.g., filtering.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
358, for a sand mold with a strainer means.
- SEE OR SEARCH CLASS:  
210, Liquid Purification or Separation, appropriate subclasses for processes and apparatus for solid-liquid separation.
- 135** This subclass is indented under subclass 133. Process wherein the charge is brought into the shaping cavity as two or more separate flows.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
93, for a process of simultaneously introducing plural different metal streams into a mold.
- 136** This subclass is indented under subclass 133. Process wherein the control or manipulation is accomplished by a changing orientation or position of the shaping surface, introduction means or some portion of these members.
- 137** This subclass is indented under subclass 47. Process wherein two or more members of a mold are brought into operative casting relationship.
- (1) Note. Included herein are generally patents which include a unique mold assembly.

- bling operation. Numerous patents which are directed to a particular casting operation will also disclose or claim a mold assembling operation. Such patents are cross-referenced here only where the evidence shows the mold assembling operation to be nonconventional.
- 138** This subclass is indented under subclass 47. Process wherein a particular material is used as a coating, lining or mold in the process.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 33+, for process of shaping a forming surface by lining.
- 72+, for processes of coating the mold before casting.
- 520+, for process of shaping particular mold materials.
- SEE OR SEARCH CLASS:
- 106, Compositions: Coating or Plastic, appropriate subclasses for mold or coating compositions.
- 249, Static Molds, subclasses 112+ for static molds employing a removable or movable liner. Subclass 114.1 for static molds employing a coating or adherent layer.
- 427, Coating Processes, subclasses 133+ for processes of coating, per se.
- 139** This subclass is indented under the class definition. Apparatus for casting a surface capable of conveying intelligence or design by reproducing in printed form, e.g., type and stereotype plates.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 332+, for apparatus specially adapted for casting a backup member to a pre-formed electrotype shell.
- SEE OR SEARCH CLASS:
- 29, Metal Working, subclass 21 for apparatus for finishing stereotype plates.
- 199, Type Casting, for apparatus for casting elements or bars of a printing form.
- 204, Chemistry: Electrical and Wave Energy, appropriate subclasses for electrolytic apparatus for forming electrotype plates.
- 249, Static Molds, for static stereotype molds, particularly subclass 138 for pivotable type stereotype molds.
- 409, Gear Cutting, Milling, or Planing, subclass 309 for apparatus for planing a concave surface such as the surface of a stereotype plate.
- 140** This subclass is indented under subclass 139. Apparatus including means combined with the casting means for cutting or trimming the cast plate while said casting is associated with the mold or a portion of the mold.
- (1) Note. The term mold as used herein includes (1) the core or cores, (2) core-like elements associated with gate portions of the casting and used for handling, and (3) conveying means serving to support a continuous casting while said casting is still associated with the molding means.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 262+, for forming apparatus including a product cutting or trimming means.
- 141** This subclass is indented under subclass 139. Apparatus which includes a separate container for fluidizing or maintaining fluid for the casting material.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 335+, for forming apparatus combined with a ladle or crucible.
- 142** This subclass is indented under subclass 141. Apparatus with means for metering or controlling the flow of molten cast material from the melting chamber to the casting chamber.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 304, for injection shaping apparatus having a valved mold gate.
- 337, for forming combined with flow control conduit means intermediate the mold and receptacle.

- 143** Apparatus under subclasses 520+ which include a means applying pressure to introduce the casting material into the shaping member.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

284+, for pressure forming means.

- 144** This subclass is indented under subclass 139. Apparatus including a mold with additional heating or cooling means therefore for treating or conditioning the metal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

338.1+, for a mold including a heating means.

348, for a means including a means to apply a coolant thereto.

- 145** This subclass is indented under subclass 139. Apparatus which includes means for separating or withdrawing the cast printing plate from the shaping surface.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

344+, for a mold including means to eject or separate a product.

401+, for strippers or ejectors, per se.

- 146** This subclass is indented under the class definition. Apparatus which includes means for (1) directly applying magnetic forces to material which is to be a part of the product, e.g., metal charge, insert, etc., or for (2) applying the magnetic forces to move or position the shaping parts.

- (1) Note. To be included in (2) supra, the force to move the shaping part has to be generated by a magnetic force although it may be indirectly applied through mechanical linkages.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

492+, for processes of directly applying magnetic energy to work.

**147.1 By electromagnetic means:**

This subclass is indented under subclass 146. Apparatus directed to means for applying electromagnetic energy directly to the apparatus parts or to the work material.

- (1) Note. A disclosure or recitation of electromagnetic means whether applied to the shaping member, in a circuit, used as a switch, or as an element for any function in the apparatus is included herein.

**148.1 For holding or assembling shaping parts:**

This subclass is indented under subclass 147.1. Apparatus wherein the electromagnetic means positions, clamps, or brings into operative relation, portions of a forming structure.

- 149** This subclass is indented under the class definition. Apparatus combined with means to apply a lubricant between moving apparatus parts.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

72+, for process of coating-treating a mold.

SEE OR SEARCH CLASS:

184, Lubrication, apparatus subclasses for lubricating apparatus.

**150.1 WITH SIGNAL, INDICATOR OR INSPECTION MEANS:**

This subclass is indented under the class definition. Apparatus having means for visual, auditory, or tactile annunciation or recording of a condition therein, or means permitting observation of a portion thereof normally hidden from view.

- (1) Note. Included herein are the indicia type indicators for imprinting reference symbols in the cast product.

- (2) Note. Included herein is an apparatus having a particular condition intended to be interpreted by human intelligence.

SEE OR SEARCH CLASS:

116, Signals and Indicators, for a mechanical signaling device, per se.

249, Static Molds, subclass 53 for static molds including a static gage, level, plumb, or level markings.

- 340, Communications: Electrical, appropriate subclasses for an electrically powered indicator, per se; see particularly subclasses 815.01+ for a visual indicator, subclasses 384+ for an audible indicator, and subclass 407 for a tactile indicator; subclasses 500+ for electrical automatic condition responsive indicating systems.
- 374, Thermal Measuring and Testing, subclasses 139+ for a thermometer for molten metal.
- 151** This subclass is indented under subclass 150. Apparatus wherein the means is an indicator to quantitatively show fluid pressure.
- SEE OR SEARCH CLASS:
- 340, Communications: Electrical, subclass 626 for electrical automatic fluid pressure responsive indicating systems.
- 151.1 Including speed sensor:**  
This subclass is indented under subclass 150.1. Apparatus having means for detecting the velocity of the product, melt, or any component of the apparatus.
- SEE OR SEARCH CLASS:
- 73, Measuring and Testing, subclasses 488+ for a device to measure speed or acceleration.
- 151.2 Including position or spatial dimension sensor:**  
This subclass is indented under subclass 150.1. Apparatus having means for detecting (a) the location of a component or product therein, (b) the relative placement between any two components or between a component and a product therein, or (c) the lineal extent of a component or product therein.
- SEE OR SEARCH CLASS:
- 33, Geometrical Instruments, subclasses 483+ for straight edge rules.
- 151.3 Melt level sensor:**  
This subclass is indented under subclass 151.2. Apparatus having means for detecting the height of liquid metal therein.
- (1) Note. The liquid metal detected may be in the source (e.g., tundish, etc.), the mold, or any component of the apparatus.
- SEE OR SEARCH CLASS:
- 73, Measuring and Testing, subclasses 290+, particularly subclasses 305+, for a device for measuring liquid level using a float.
- 151.4 Including thermal sensor:**  
This subclass is indented under subclass 150.1. Apparatus having means for detecting a process parameter related to heat (e.g., temperature, heat transfer rate, enthalpy, heat capacity, etc.) of the melt, product, or apparatus, per se.
- SEE OR SEARCH CLASS:
- 374, Thermal Measuring and Testing, particularly subclasses 45+ for a device to determine a non-thermal property from a thermal measurement.
- 151.5 For detecting or predicting breakout of continuous casting strand:**  
This subclass is indented under subclass 151.4. Apparatus having means for detecting a failure or imminent failure of the shell of a continuous casting strand to contain the molten center.
- (1) Note. See the GLOSSARY for a definition of "continuous casting strand."
- 152** This subclass is indented under the class definition. Apparatus combined with means to prevent injury to workman or apparatus in event of malfunctioning or in the operation of the apparatus or a portion thereof.
- (1) Note. Means which merely function to aid or promote the comfort of the operator are not considered to come within the scope of this subclass.
- 153** This subclass is indented under subclass 152. Apparatus wherein the safety means prevent damage to the apparatus in the event of malfunctioning.
- (1) Note. Means which are used to allow each cycle of the machine to be completed as scheduled are not considered to

be safety means responsive to a malfunctioning since they are actuated in the performance of every complete cycle.

**154.1 CONTROL MEANS RESPONSIVE TO OR ACTUATED BY MEANS SENSING OR MEASURING A CONDITION OR VARIABLE (I.E., AUTOMATIC CONTROL):**

This subclass is indented under the class definition. Apparatus having means to regulate the operation thereof influenced by means monitoring a process parameter of the apparatus.

- (1) Note. A patent need not claim the monitoring means to be classified hereunder, so long as it claims the regulating means.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 151.5, for an apparatus having means to indicate a failure or imminent failure of a continuous casting strand.

SEE OR SEARCH CLASS:

- 318, Electricity: Motive Power Systems, for a servo motor and controller, per se.  
700, Data Processing: Generic Control Systems or Specific Applications, subclasses 1 through 89 for computer controlled systems or methods, generally, and subclasses 197-205 and subclasses 207-212 particularly for control systems related to molding and melting, respectively.

**154.2 Responsive to position or spatial dimension:**  
This subclass is indented under subclass 154.1. Apparatus wherein the process parameter monitored is (a) the location of a component or product therein, (b) the relative placement between any two components or between a component and a product therein, or (c) the lineal extent of a component or product therein.

**154.3 Responsive to rate of change:**  
This subclass is indented under subclass 154.2. Apparatus wherein the process parameter monitored is a mathematical derivative (e.g., first, second, third, etc.) of the location or size of the product, melt, or any component of the apparatus with respect to time.

SEE OR SEARCH CLASS:

- 73, Measuring and Testing, subclasses 488+ for a device to measure speed and subclasses 861+ for a device to measure volume or flow rate.

**154.4 Continuous casting:**

This subclass is indented under subclass 154.3. Apparatus which produces a continuously cast product.

- (1) Note. See GLOSSARY for a definition of "continuous casting."

**154.5 Continuous casting:**

This subclass is indented under subclass 154.2. Apparatus which produces a continuously cast product.

- (1) Note. See GLOSSARY for a definition of "continuous casting."

**154.6 Responsive to thermal condition:**

This subclass is indented under subclass 154.1. Apparatus wherein the process parameter monitored is related to heat (e.g., temperature, heat transfer rate, enthalpy, heat capacity, etc.) of the melt, product, or apparatus, per se.

SEE OR SEARCH CLASS:

- 374, Thermal Measuring and Testing, particularly subclasses 45+ for a device to determine a nonthermal property from a thermal measurement.

**154.7 Continuous casting:**

This subclass is indented under subclass 154.6. Apparatus which produces a continuously cast product.

- (1) Note. See GLOSSARY for a definition of "continuous casting."

**154.8 Responsive to pressure:**

This subclass is indented under subclass 154.1. Apparatus wherein the process parameter monitored is force per unit area applied to the melt, the product, or any component of the apparatus.

SEE OR SEARCH CLASS:

- 73, Measuring and Testing, subclasses 700+ for a fluid pressure gauge.



**155.1 Control of feed material enroute to shaping area:**

This subclass is indented under subclass 154.1. Apparatus wherein the operation regulated is the delivery of a substance comprising (a) molten metal or additives therefor to a mold or (b) sand, binder, or other additives therefor to a mold forming means.

**155.2 Responsive to material level:**

This subclass is indented under subclass 155.1. Apparatus wherein the process parameter monitored is the fill height of the substance in a supply (e.g., tundish, etc.), a mold, or any component of the apparatus.

**SEE OR SEARCH CLASS:**

340, Communications: Electrical, subclasses 612+ for condition responsive indicating system responsive to material level.

**155.3 Responsive to pressure:**

This subclass is indented under subclass 155.1. Apparatus wherein the parameter monitored is force per unit area applied to the melt, the product, or any component of the apparatus.

**SEE OR SEARCH CLASS:**

73, Measuring and Testing, subclasses 700+ for a fluid pressure gauge.

**155.4 Responsive to position or spatial dimension:**

This subclass is indented under subclass 155.1. Apparatus wherein the process parameter monitored is (a) the location of a component or product therein, (b) the relative placement between any two components or between a component and a product therein, or (c) the lineal extent of a component or product therein.

**155.5 Responsive to rate of change:**

This subclass is indented under subclass 155.4. Apparatus wherein the process parameter monitored is a mathematical derivative (e.g., first, second, third, etc.) of the location or size of the product, melt, or any component of the apparatus with respect to time.

**SEE OR SEARCH CLASS:**

73, Measuring and Testing, subclasses 488+ for a device to measure speed and subclasses 861+ for a device to measure volume or flow rate.

**155.6 Responsive to thermal condition:**

This subclass is indented under subclass 155.1. Apparatus wherein the process parameter monitored is related to heat (e.g., temperature, heat transfer rate, etc.) of the melt, product, or apparatus, per se.

**SEE OR SEARCH CLASS:**

374, Thermal Measuring and Testing, particularly subclasses 45+ for a device to determine a non-thermal property from a thermal measurement.

**155.7 Responsive to weight:**

This subclass is indented under subclass 155.1. Apparatus wherein the parameter monitored is the gravitational force on the melt, the product, or any component of the apparatus, per se.

**SEE OR SEARCH CLASS:**

73, Measuring and Testing, appropriate subclasses for a device to measure a condition derived from a weight measurement.  
177, Weighing Scales, for means to measure weight, per se.

**156.1 Including electrode or float sensor:**

This subclass is indented under subclass 155.2. Apparatus including means for detecting the process parameter comprising either an electrically conductive probe or a buoyant means.

**SEE OR SEARCH CLASS:**

73, Measuring and Testing, subclasses 290+, particularly subclasses 305+, for a device for measuring liquid level using a float.

**157** This subclass is indented under the class definition. Apparatus having a means independent of the apparatus work performing parts, which allows a set time period to elapse during an apparatus operation.

- 158** This subclass is indented under the class definition. Apparatus including positive means for removing undesirable material from a mold making or metal casting apparatus.
- SEE OR SEARCH CLASS:
- 15, Brushing, Scrubbing, and General Cleaning, appropriate subclasses, for apparatus for cleaning of general application.
- 134, Cleaning and Liquid Contact With Solids, appropriate subclasses, for a liquid contact process or apparatus for cleaning.
- 159** This subclass is indented under the class definition. Apparatus for shaping a mold, pattern or core device.
- 160.1 Including means applying vacuum directly to mold material:**  
This subclass is indented under subclass 159. Apparatus including means for directly applying a suction to work material.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 253+, for casting apparatus including vacuum means.
- 160.2** This subclass is indented under subclass 160.1. And means to apply consumable shielding film to shaping surface: Apparatus including an impervious consumable membrane adhered onto a particulate shaping surface by the applied suction.
- 161** This subclass is indented under subclass 159. Apparatus including mold forming means in which material is removed by the operation of a moving sweep, strickle, profile pattern or cutter.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 40, for mold shaping processes utilizing a pattern as a compaction means, e.g., profile pattern, etc.
- 162** This subclass is indented under subclass 161. Apparatus which includes means specially adapted to remove material for forming a sprue or riser in a mold structure.
- 163** This subclass is indented under subclass 161. Apparatus having means for removing surface material from the core as it is being rotated.
- 164** This subclass is indented under subclass 161. Apparatus wherein a revolvable pattern or pattern part is utilized as the sweeping member.
- (1) Note. A rotary cutting tool which shapes the mold is not considered a pattern or pattern part to be encompassed herein.
- 165** This subclass is indented under subclass 159. Apparatus with means specially adapted for shaping thin mold sections of resin-sand mixtures, i.e., shell molds.
- (1) Note. Depending upon the extent of unsupported shell sections and the gravity head of the liquid or molten casting metal, the shell may be externally backed up with steel shot, sand or similar material.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 21, for shell molding processes of spraying mold materials against a shaping surface.
- 361, for shell molds.
- 526+, for processes of shaping fluent mold material containing resin.
- 166** This subclass is indented under subclass 165. Apparatus which includes plural distinct stations, e.g., dispensing, for compacting, curing oven, ejection means, etc., for performing manufacturing operations upon the shell molds being formed.
- 167** This subclass is indented under subclass 159. Apparatus for shaping a mold in combination with means for introducing casting material to the mold.
- (1) Note. Found herein are apparatus and plants for molding in which there is an alleged combination between mold making and metal casting.

- 168 This subclass is indented under subclass 167. Apparatus which includes assembling means for operatively positioning formed mold sections or parts.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
339+, for a mold including assembling means.
- 169 This subclass is indented under subclass 159. Apparatus wherein the mold shaping operation is performed by pressure means which function to ram pack or compress the mold material.
- SEE OR SEARCH CLASS:  
100, Presses, appropriate subclasses, for presses.  
425, Plastic Article or Earthenware Shaping or Treating: Apparatus, appropriate subclasses for means for shaping plastic or fluent material, especially subclasses 376.1+ for an extrusion molding machine, subclasses 406+ for a press molding machine, and subclasses 425+ for the combination of a female mold and a tamper or vibrator; see the search notes thereunder.
- 170 This subclass is indented under subclass 169. Apparatus with resilient pressure exerting means for effecting compaction of the mold forming material.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclass 65, for static molds having an inflatable element.
- 171 This subclass is indented under subclass 170. Apparatus directed to utilizing plural contiguous or plural independent diaphragms members.
- 172 This subclass is indented under subclass 169. Apparatus wherein two or more pressing heads are utilized in shaping the mold material.
- 173 This subclass is indented under subclass 172. Apparatus wherein the rammers are powered by fluid pressure means.
- (1) Note. The pressure does not have to be directly applied to the rammer but may be transmitted through a mechanical linkage.
- 174 This subclass is indented under subclass 169. Apparatus for shaping cores by forcing the material through a die orifice.
- 175 This subclass is indented under subclass 169. Apparatus wherein the mold material is impelled radially outwardly against the forming surface by the rotation of the surface.
- 176 This subclass is indented under subclass 169. Apparatus for forming hollow cylindrical molds which are to be used as pipe molds.
- 177 This subclass is indented under subclass 176. Apparatus wherein the compacting force is effected by a motive pattern member.
- 178 This subclass is indented under subclass 177. Apparatus wherein the compacting action is effected by (1) rotation of the pattern member or (2) rotation of the flask as the pattern member is progressively advanced therethrough.
- 179 This subclass is indented under subclass 178. Apparatus wherein a rotating former or pattern is utilized to form beads at the end of the pipe mold.
- 180 This subclass is indented under subclass 169. Apparatus including means operable for relatively drawing mold parts from the shaping member after compaction.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
213+, for apparatus having withdrawing means without compacting means.  
401+, for, per se, withdrawing means.
- 181 This subclass is indented under subclass 180. Apparatus including a distinct withdrawing station subsequent to the compaction station.
- 182 This subclass is indented under subclass 180. Apparatus directed to means adapted to separate a pattern from cope and drag members where the pattern is situated intermediate said members and wherein said means effects a parallel draw of cope and pattern respectively from each other and the drag.

- 183** This subclass is indented under subclass 180. Apparatus directed to a machine with means for turning the pattern, flask or shaping member.
- (1) Note. The inverting means may serve a dual function, i.e., invert the shaping member and also effect the withdrawal operation or may only serve to deliver the shaping member to the withdrawal station.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 209, for a press molding machine having an invertible table.
- 224, for molding apparatus having an inverting means.
- 402, for, per se, means for inverting a pattern for stripping.
- 409, for, per se, means for turning a pattern plate or mold around a horizontal axis.
- 184** This subclass is indented under subclass 183. Apparatus wherein the inverting means rotates the entire mold machine, i.e., the press head as well as the mold supporting unit.
- 185** This subclass is indented under subclass 183. Apparatus characterized by having the frame that inverts the pattern plate oscillatorily supported about an axis located to one side.
- (1) Note. The above apparatus is to be distinguished from the roll over type machine characterized by having a frame that carries the pattern plate, oscillatorily supported about a substantially central axis.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 205, for vibrating compaction machine of the roll or rockover type.
- 186** This subclass is indented under subclass 180. Apparatus wherein the shaped forming surface is a core member.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 228+, for core shaping means, per se.
- 187** This subclass is indented under subclass 180. Apparatus wherein the pattern member acts as the primary compressing member in shaping the forming surface, i.e., the shaping or compacting force is transmitted through or by the pattern member.
- (1) Note. The pattern surface acts as the parting surface during the withdrawal.
- 188** This subclass is indented under subclass 187. Apparatus having a plate that fits accurately around the pattern and through which the patterns are drawn either by moving the pattern supports down or by raising the plate and the mold half upwardly free from the pattern.
- 189** This subclass is indented under subclass 180. Apparatus which includes a vibrator for facilitating the withdrawal or separation.
- (1) Note. The vibrating means found herein generally perfect the drawing operation and usually are combined with another withdrawing means.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 223, for molding apparatus including vibrating or rapping separation means.
- 260+, for general apparatus with vibrator means.
- 190** This subclass is indented under subclass 180. Apparatus having a plate member that fits accurately around the pattern and supports the sand of the shaped member during withdrawal of the pattern.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 217+, for molding apparatus including stripping plate separation means.
- 191** This subclass is indented under subclass 180. Apparatus having means for vertically downwardly displacing the pattern member from the shaped surface.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
225, for molding apparatus having a drop pattern support separating means.
- 192** This subclass is indented under subclass 169. Apparatus which includes means for dispensing discrete charges or portions of mold forming materials into a flask or receptacle under the influence of gravity.
- SEE OR SEARCH CLASS:  
141, Fluent Material Handling, With Receiver or Receiver Coacting Means, appropriate subclasses, for apparatus for handling fluent material.  
222, Dispensing, appropriate subclasses for fluent material dispensing apparatus.
- 193** This subclass is indented under subclass 192. Apparatus which includes means for discharging a predetermined quantity of mold forming material into a flask or receptacle.
- 194** This subclass is indented under subclass 192. Apparatus including separate and distinct means for charging a mold forming means with molding material and means for compacting the mold material.
- 195** This subclass is indented under subclass 169. Apparatus having two or more dynamic mold compaction means identifiable as separate units each doing a complete operation of a different kind, e.g., mold pressing means combined with mold vibrating means, blow molding means combined with mold vibrating means, etc.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
38, for processes of compacting mold materials utilizing diverse pressure applications.
- 196** This subclass is indented under subclass 195. Apparatus comprising press forming means combined with means to shape by vibration.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
203+, for a vibrating compaction.
- 207+, for a press molding means.
- 197** This subclass is indented under subclass 196. Apparatus wherein the compacting means includes a pressure member which exerts a vibratory force in addition to a pressing type force.
- 198** This subclass is indented under subclass 169. Apparatus having means operable for mechanically slinging wads of sand at high velocity onto the shaping surface.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
19, for processes of shaping a forming surface by spraying or slinging mold material.
- 199** This subclass is indented under subclass 198. Apparatus with a swinging arm including the slinging means which can be positioned above any portion of the flask or receptacle.
- 200** This subclass is indented under subclass 169. Apparatus comprising means utilizing a gaseous pressure discharge assistant for projecting mold forming material against a shaping surface.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
19+, for blow type molding processes.
- 201** This subclass is indented under subclass 200. Apparatus including means for relatively positioning the blow chamber and shaping member for operational engagement.
- 202** This subclass is indented under subclass 200. Apparatus combined with a perforated element to (1) distribute the gaseous pressure medium or (2) distribute the mold forming material just prior to contact with the shaping surface.
- 203** This subclass is indented under subclass 169. Apparatus wherein the compacting operation on the mold forming material is performed by means effecting a vibrating, jarring or jolting action upon the mold forming material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 195+, for plural compacting means including vibrating, jarring or jolting means.
- 260+, for subject matter of this class combined with vibrator means.

SEE OR SEARCH CLASS:

- 366, Agitating, subclasses 108+ for agitation by vibration.

**204** This subclass is indented under subclass 203. Apparatus including a static rammer means which cooperates in the compaction of the mold forming material.

**205** This subclass is indented under subclass 203. Apparatus wherein a pattern supporting frame is either oscillatorily supported about an axis located to one side of the machine, i.e., rock over type, or oscillatorily supported about a substantially central axis of the machine, i.e., roll over type.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 183+, for rock-over and roll-over type compacting machines which include a pattern withdrawal means.
- 209, for a press molding machine with an invertible table.
- 224, for shaping apparatus having inverting means.
- 375, for a rock or roll-over flask.
- 402, for stripping means including pattern inverting means.
- 409, for, per se, means of inverting a pattern member.

**206** This subclass is indented under subclass 203. Apparatus having fluid pressure actuator means for effecting the vibrating, jarring or jolting operation.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 261, for apparatus of this class including fluid pressure actuated vibrator means.

**207** This subclass is indented under subclass 169. Apparatus employing a dynamic pressure member for shaping the mold material.

- (1) Note. Apparatus included herein is either a press machine or press members to be employed therein. A machine is an apparatus which follows a mechanical law defined by its structure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 169, for hand held pressure applying mold shaping members.

SEE OR SEARCH CLASS:

- 100, Presses, appropriate subclasses for residual processes and apparatus for subjecting material to compressive forces.

**208** This subclass is indented under subclass 207. Apparatus wherein the press member has an annular compacting surface which is rotated.

**209** This subclass is indented under subclass 207. Apparatus in which a planar surface which holds the work is capable of being turned over.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 183+, for mold shaping apparatus having means to invert the pattern, flask or shaping member.
- 409, for means for turning over a pattern member.

**210** This subclass is indented under subclass 207. Apparatus comprising a single plunger co-acting with individual molds of a group successively presented by movable mold shaping member support means.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 18, for processes of shaping molds sequentially.

**211** This subclass is indented under subclass 207. Apparatus wherein the pressure platen is pivoted for displacement transversely of the compressing direction to a nonuse direction.

**212** This subclass is indented under subclass 207. Apparatus including fluid pressure means moving a mold shaping member in an oscillatory or reciprocatory movement, generally to provide

- engagement with a substantially stationary rammer member.
- 213** This subclass is indented under subclass 159. Apparatus having means to effect a withdrawal of the shaped mold part from the mold shaping member or vice versa.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
180+, for compacting means including withdrawal means.  
401+, for stripper or ejectors, per se.
- 214** This subclass is indented under subclass 213. Apparatus which includes means for withdrawing the cope from the pattern and the pattern from the drag in parallel relation by a true rectilinear movement.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
182, for compacting means including means for withdrawing pattern member intermediate the cope and drag.
- 215** This subclass is indented under subclass 213. Apparatus having means which effect withdrawal of the pattern by a rotational movement.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
240, for a rotatable or pivotal pattern plate associated with a flask member.  
247, for a rotatable or pivotal pattern, per se.
- 216** This subclass is indented under subclass 215. Apparatus wherein the pattern member has a helical thread or groove.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclass 59 for non-sand type static molds which produce a helical or threaded type product.
- 217** This subclass is indented under subclass 213. Apparatus including a plate member surrounding the pattern which functions to maintain the mold material during withdrawal of the pattern.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
190, for apparatus for compacting mold materials including a stripping plate for facilitating withdrawal of the pattern.
- 218** This subclass is indented under subclass 217. Apparatus directed to means for withdrawing the pattern vertically downwardly from the shaped member.
- 219** This subclass is indented under subclass 218. Apparatus directed to means for withdrawing a pattern which effect an equal and parallel draw motion to the pattern with reference to at least two points.
- (1) Note. The withdrawing force must be applied to at least two points and does not include those means in which the force is applied at a single point and the pattern merely guided along parallel lines.
- 220** This subclass is indented under subclass 218. Apparatus wherein a stool is utilized to support a section of the mold inside the stripping plate during the withdrawal of the pattern member.
- (1) Note. The stool generally supports a green sand core during the withdrawing of the pattern member.
- 221** This subclass is indented under subclass 218. Apparatus directed to utilizing lever and link means to effect a withdrawal of the pattern member.
- 222** This subclass is indented under subclass 213. Apparatus wherein a plural movable part pattern is utilized as the shaping member.
- 223** This subclass is indented under subclass 213. Apparatus with means for drawing a mold shaping member from a mold with or without lifting the mold or stripping the pattern in which the operation is facilitated by means vibrating or rapping the shaping member or work piece either before or after the drawing operation commences.

- (1) Note. Included herein are apparatus having devices adapted to be vibrated and to communicate vibrations to the shaping member, per se.
- 224** This subclass is indented under subclass 213. Apparatus including means for inverting or turning the mold shaping member upside down or vice versa to facilitate the withdrawal operation.
- 225** This subclass is indented under subclass 213. Apparatus which includes means for holding the flask and pattern while the mold is being formed and which will be capable of drawing the pattern downwardly from the mold.
- (1) Note. Generally the pattern is mounted on reciprocal pattern head means for positioning and stripping the pattern.
- 226** This subclass is indented under subclass 213. Apparatus with ejector pin means for contacting the mold part to effect a lifting of the mold part from the shaping member or vice versa.
- 227** This subclass is indented under subclass 213. Apparatus with means for separating the mold shaping member from the mold by lifting the latter off the shaping member, in which the shaping member has no movement during the mold lifting operation.
- 228** This subclass is indented under subclass 159. Apparatus comprising means defining a forming surface in which cores are shaped.
- 229** This subclass is indented under subclass 228. Apparatus wherein the core shaping means includes an indicia or character forming member.
- 230** This subclass is indented under subclass 228. Apparatus with a preform part, located therein, which is to become integrated with the core member during the shaping of the said member.
- 231** This subclass is indented under subclass 230. Apparatus wherein the preform part is to be incorporated into the final cast product.
- 232** This subclass is indented under subclass 228. Apparatus wherein the core shaping means is comprised of plural movable parts which are adapted to produce a cavity or undercut portion in the core member.
- (1) Note. Mere vent forming means are not considered means for forming a recess or cavity within the scope of this subclass.
- 233** This subclass is indented under subclass 228. Apparatus directed to a split core mold or box which is hinged on one side.
- 234** This subclass is indented under subclass 228. Apparatus which includes means defining venting passages in the core box or means for forming vents in the shaped core member.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
410, for vents or vent forming apparatus, per se.
- 235** This subclass is indented under subclass 159. Apparatus comprising a forming element, i.e., pattern or part of pattern, for shaping a mold.
- 236** This subclass is indented under subclass 235. Apparatus wherein the pattern is adapted to support an insert or chill.
- 237** This subclass is indented under subclass 235. Apparatus in combination with a container or box without top and without fixed bottom for confining mold material in which the same is being shaped.
- (1) Note. The flask may either consist of (1) the cope, (2) the drag or (3) the cope and drag.
- 238** This subclass is indented under subclass 237. Apparatus wherein the pattern or pattern holding member is supported by apertures in the flask wall or flask supporting member, e.g., follow board, etc.
- (1) Note. The flask supporting member may be a plate or follow board upon which the flask walls and pattern rest, e.g., a flask supported on a follow board having



- an aperture in which the pattern rests would be encompassed herein.
- 239** This subclass is indented under subclass 237. Apparatus wherein the pattern is (1) a match pattern plate or (2) the pattern is temporarily or permanently supported by the plate or board during the mold shaping operation.
- 240** This subclass is indented under subclass 239. Apparatus wherein the pattern is rotatable or pivotable with respect to the flask.
- 241** This subclass is indented under subclass 235. Apparatus including plate means for temporarily or permanently supporting patterns and parts of patterns during molding combined solely with the patterns themselves.
- 242** This subclass is indented under subclass 241. Apparatus which include gate former means attached to the pattern - match plate proper.
- 243** This subclass is indented under subclass 241. Apparatus with a cope pattern located on one side of the pattern plate and a drag pattern located opposite said cope pattern on the other side of the plate, said apparatus being an integral unit.
- 244** This subclass is indented under subclass 235. Apparatus which includes means for forming a sprue, gate or runner in the mold.
- (1) Note. The means for forming the sprue, gate or runner is generally attached to the pattern.
- 245** This subclass is indented under subclass 235. Apparatus wherein the pattern means is particularly adapted for producing undercut parts in the mold.
- 246** This subclass is indented under subclass 245. Apparatus wherein the pattern is formed of destructible material.
- 247** This subclass is indented under subclass 245. Apparatus wherein the pattern is adapted to be withdrawn solely by nonlinear movement, e.g., screw type pattern.
- 248** This subclass is indented under subclass 245. Apparatus wherein the pattern is composed of at least two parts which are relatively separable.
- 249** This subclass is indented under subclass 235. Apparatus for patterns defined in terms of a series of materials whether or not other structural features of the pattern are recited.
- 250.1** **MEANS TO DIRECTLY APPLY ELECTRICAL OR WAVE ENERGY TO WORK:** This subclass is indented under the class definition. Apparatus which includes means to apply an energy quantity directly to work material either as (a) wave energy in the frequency spectrum above the lower audio frequency range, (i.e., fifty cycles per second), or (b) an electric field or force.
- (1) Note. In order for radiant energy to be placed herein, the radiant heat must be specifically claimed.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**  
48+, for processes of direct application of electrical or wave energy to work.
- 253** This subclass is indented under the class definition. Apparatus combined with means for (1) exhausting or partially exhausting air or other gas from the work material, (2) directly applying a vacuum or suction to work material either in a melting furnace, material receptacle, or before, during or after charging of the work material into a shaping member, or (3) applying vacuum or suction to the apparatus or portions thereof for positioning, retaining or aligning of parts.
- (1) Note. The application of the vacuum or suction may perform a dual function, e.g., exhaust air or other gases from the mold or work material and also effect movement of the work material.
- SEE OR SEARCH THIS CLASS, SUBCLASS:**  
16+, for process of utilizing a vacuum.

- 254** This subclass is indented under subclass 253. Apparatus wherein the vacuum or suction is directly applied to molten casting material.
- 255** This subclass is indented under subclass 254. Apparatus wherein the vacuum is applied to the casting material through a vent or minute openings in a mold wall.
- 256** This subclass is indented under subclass 254. Apparatus which includes means for directly applying a vacuum or suction in a closed system encompassing a receptacle and a casting mold.
- (1) Note. The closed system may include a melting furnace, an intermediate charging chamber and a casting chamber and the vacuum or suction may be applied in all or any one of them.
- 257** This subclass is indented under subclass 256. Apparatus with vacuum or suction means for feeding the molten metal into the charging chamber receptacle.
- (1) Note. The vacuum or suction effect may be created by a pressure cylinder which operates to force the molten metal from the charging receptacle to the mold.
- 258** This subclass is indented under subclass 256. Apparatus wherein the closed system includes a melting chamber receptacle.
- (1) Note. The recitation of a melting furnace without claimed heating means is sufficient for this subclass.
- 259** This subclass is indented under the class definition. Apparatus combined with means for providing a special inert or deoxidizing atmosphere.
- (1) Note. To be within the scope of this subclass, the inert or deoxidizing atmosphere must be claimed as such.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
66.1+, for processes of applying an inert or reducing gaseous atmosphere to work.
- 475, for continuous casting processes including a reducing gas or inert atmosphere.
- 260** This subclass is indented under the class definition. Apparatus combined with means for effecting a vibratory motion.
- (1) Note. "Vibratory" includes any form of reciprocating or oscillating jarring motion.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
478, for processes of vibrating while continuously casting.
- 261** This subclass is indented under subclass 260. Apparatus wherein the vibrator means is actuated by fluid pressure.
- 262** This subclass is indented under the class definition. Apparatus which includes casting means combined with means for cutting or trimming the casting while it is associated with the mold or a portion of the mold.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclass 52 for static molds employing a static means to produce a groove or depression in the product to facilitate breaking or cutting.
- 263** This subclass is indented under subclass 262. Apparatus which includes continuous casting means combined with severing means.
- 264** This subclass is indented under subclass 262. Apparatus wherein a gate forming member severs a gate from the cast product.
- 265** This subclass is indented under subclass 262. Apparatus directed to rod or punch means which are actuatable to sever the casting from the gate portion.
- 266** This subclass is indented under the class definition. Apparatus which includes a means to chemically purify an ore or combined metal to produce a metal value.

**SEE OR SEARCH CLASS:**

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for processes for producing metals.
- 266, Metallurgical Apparatus, appropriate subclasses for refining apparatus.
- 423, Chemistry of Inorganic Compounds, subclasses 1+ for chemical processes of obtaining metal containing compounds from mixtures.

- 267** This subclass is indented under the class definition. Apparatus which includes a means to apply a layer to a base by a coating operation which base and layer are to be a composite product.

**SEE OR SEARCH CLASS:**

- 118, Coating Apparatus, appropriate subclasses for coating apparatus.

- 268** This subclass is indented under subclass 267. Apparatus wherein the base is a continuously cast product.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 419, for apparatus for casting metal onto a running indefinite length base.
- 472, for processes of lubricating continuous casting molds.

- 269** This subclass is indented under the class definition. Apparatus which includes a means for placing, conveying or otherwise moving in a nonmanufacturing manner the product or product portion of a casting operation after the product or product portion has been separated for the shaping surface.

- (1) Note. Merely ejecting or removing the product from a mold will not bring the patent to this subclass. The manipulation must be more than a mere perfecting of the casting operation.

**270.1 COMBINED:**

This subclass is indented under the class definition. Apparatus which includes a means to perform an operation which is, per se, not of

this class and is not a perfecting means for an operation of this class.

- 271** This subclass is indented under the class definition. Apparatus wherein such apparatus provides a surface to impart a shape to molten metal as it freezes.

**SEE OR SEARCH CLASS:**

- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, appropriate subclasses for molding apparatus for shaping or reshaping fluent or plastic material not elsewhere provided for; especially see subclasses 78+ for means for molding powdered metal.
- 428, Stock Material or Miscellaneous Articles, subclasses 544+ for stock materials, e.g., of indefinite length, which are all metal or have adjacent metal components.

- 272** This subclass is indented under subclass 271. Apparatus wherein a means is employed to shape molten metallic material by peripherally confining, or engaging with a surface only a relatively small portion of the body of molten material, but shaping the entire body by moving it across the surface.

**SEE OR SEARCH CLASS:**

- 65, Glass Manufacturing, subclasses 21.1+ and 142+ for processes and apparatus respectively for particulate bead or ball making.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 5+ for molten metal comminuting and solidifying processes.
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 332+ for a ball former comprising means imparting a rolling action to a discrete charge of nonmetallic material.

- 284** This subclass is indented under subclass 271. Apparatus wherein the means shapes by a force other than gravity.

- (1) Note. The term pressure shaping includes all force type operations of bringing the metal into contact with a

shaping surface, e.g., centrifugal force, kinetic force, fluid pressure force, etc., except those operations where the only force is the static head of the casting material acting through a riser or gate, i.e., gravity force.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

120, for processes of applying pressure to material in a mold.

**285** This subclass is indented under subclass 284. Apparatus which includes a means for generating a gaseous product to provide the pressure shaping force.

(1) Note. The gas is generally produced by a chemical reaction or by volatilization.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

48, for processes of shaping liquid metal against a forming surface utilizing an explosive force.

307, for manually operated pressure generating means for charging molten metal.

**286** This subclass is indented under subclass 284. Apparatus where the means shapes by centrifugal force.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

114+, for processes of centrifugally casting metal.

451, for continuous or semi-continuous casting processes utilizing centrifugal force.

**SEE OR SEARCH CLASS:**

210, Liquid Purification or Separation, subclasses 360.1+ for liquid centrifugal extractors.

249, Static Molds, subclasses 137+ for a centrifugal mold.

425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclass 425, for molding apparatus utilizing mold motion (e.g., centrifugal molding, etc.), to shape a nonmetal.

**287** This subclass is indented under subclass 286. Apparatus which includes means to compensate or correct a weight differential across the axis at rotation.

(1) Note. To be included herein, a balancing means does not have to be adjustable, e.g., it may be a permanent mass diametrically opposite a mold.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

289, for molds which may disclose the counterweight.

**SEE OR SEARCH CLASS:**

74, Machine Element or Mechanism, subclass 573 for flywheels and rotors with balancing means.

**288** This subclass is indented under subclass 286. Apparatus which includes means to present a preformed article part for compositing by centrifugal force.

**289** This subclass is indented under subclass 286. Apparatus wherein a forming cavity is positioned so that the axis of rotation for centrifugal formation does not extend through it.

**290** This subclass is indented under subclass 289. Apparatus wherein two or more separate product forming cavities are employed.

**291** This subclass is indented under subclass 286. Apparatus having means to accommodate or neutralize deformations in the dimensions of the apparatus during the casting operation.

(1) Note. Included herein are apparatus constructions which are specifically determined to prevent warpage or expansion deformations from being detrimental even though a separate member or compensator is not provided.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

435, for molds having expansible walls in continuous casting apparatus.

- 292** This subclass is indented under subclass 286. Apparatus having means to detachably force fasten either (1) mold parts together or (2) a mold in the rotating device.
- SEE OR SEARCH CLASS:  
269, Work Holders, for clamping work holders, per se.
- 293** This subclass is indented under subclass 292. Apparatus wherein a clamp is actuated by the centrifugal force.
- 294** This subclass is indented under subclass 286. Apparatus which includes means to stop or slow the rotating mold.
- 295** This subclass is indented under subclass 286. Apparatus which includes means to strip the casting from the forming surface.
- 296** This subclass is indented under subclass 286. Apparatus having plural cavities extending around the axis of rotation, each of said cavities forming a separate product.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
290, for centrifugal molds having plural radially disposed molds.  
322, for plural independent molds.  
350+, for sand molds having plural article forming cavities.
- 297** This subclass is indented under subclass 286. Apparatus which includes means to apply to a mold or product a material to extract heat therefrom.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
348, for means to apply coolant to a mold or casting.
- 298** This subclass is indented under subclass 286. Apparatus wherein a mold is adapted to be centrifugally turned around a generally horizontal axis.
- 299** This subclass is indented under subclass 298. Apparatus which includes a feeding channel extending along at least a portion of the axis of rotation inside the mold.
- 300** This subclass is indented under subclass 299. Apparatus wherein the trough is enabled to turn around the axis of the horizontal mold.
- 301** This subclass is indented under subclass 299. Apparatus wherein the trough is enabled to change its position along the horizontal axis of the mold during the filling of the mold.
- 302** This subclass is indented under subclass 286. Apparatus which include a separate shaping member which forms an aperture in the product.
- 303** This subclass is indented under subclass 284. Apparatus wherein the pressure acts upon a body of the charge to force it into a confined shaping area to be shaped by said pressure.
- 304** This subclass is indented under subclass 303. Apparatus wherein a stopper or cutoff means is present in the feed port of a mold for closing the opening.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
133+, for a process of controlling the introduction of liquid metal against a forming surface.  
142, for apparatus for casting printing plates including a melting chamber having a valved gate.  
337, for means to shape metallic material including a ladle or crucible type melt receptacle having flow control means.
- 305** This subclass is indented under subclass 303. Apparatus which includes means specifically provided for facilitating the removal of gas in the article forming cavity proper or the introduction port thereto.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
61+, for processes of shaping liquid metal against a forming surface utilizing a vacuum.  
254+, for casting apparatus of this class having means to apply vacuum or suction directly to the molten casting material.  
410, for vent or vent forming apparatus, per se.

- 306** This subclass is indented under subclass 303. Apparatus wherein the injection means includes means to apply a gas pressure directly to the casting material.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 119, for processes of shaping liquid metal against a forming surface by direct fluid pressure.
- 285, for pressure shaping apparatus including a pressure gas or pressure vapor generator.
- 307** This subclass is indented under subclass 306. Apparatus which includes a hand manipulated producer for the pneumatic charging pressure.
- (1) Note. Included herein are those patents wherein muscle power is utilized in generating the pneumatic pressure force.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 284, for manually operated pneumatic pressure generating means for applying secondary pressure.
- 308** This subclass is indented under subclass 306. Apparatus which includes a cover member for a mold holding means which makes a gas tight closure and contains a port through which the pneumatic charging pressure is introduced.
- 309** This subclass is indented under subclass 306. Apparatus wherein the pneumatic pressure means forces the metal directly from a melting unit or part thereof to the casting cavity.
- (1) Note. Apparatus is included herein where a nozzle acceptor or charge form the melting unit but remains at least partially submerged in the molten metal of the unit.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 316+, for casting apparatus of the hot chamber type which utilizes a piston-cylinder charger.
- 310** This subclass is indented under subclass 309. Apparatus which includes means to accept and separate a charging portion from the bulk source.
- 311** This subclass is indented under subclass 310. Apparatus which includes a charging chamber and spout having provision for introduction of the charge through the ejection end of the spout, i.e., through the spout port that contacts the mold gate.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 336, for means to shape metallic material which includes a rotatable or dipper type dispenser.
- 312** This subclass is indented under subclass 303. Apparatus wherein the injection means comprises a piston operating through a cylinder directly on the fluid casting material.
- 313** This subclass is indented under subclass 312. Apparatus which include at least two pistons which have opposed pressure faces which act to inject the casting material.
- 314** This subclass is indented under subclass 312. Apparatus wherein the piston is operated by liquid pressure.
- 315** This subclass is indented under subclass 314. Apparatus wherein the hydraulic piston is controlled by a single valve having three or more flow lines with an actuator arranged so as to determine the relative order, duration or flow through each of the several flow lines.
- SEE OR SEARCH CLASS:
- 137, Fluid Handling, subclasses 625+ for fluid handling systems employing a multi-way valve.
- 316** This subclass is indented under subclass 312. Apparatus wherein the piston means forces the metal directly from a melting unit or charge chamber to the casting cavity.
- (1) Note. Apparatus is included herein where the charge is first segregated into a charging chamber while in the melting area.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 309, for apparatus wherein direct pneumatic charging means forces the metal directly from a melting unit to the casting cavity.
- 335, for means to shape metallic material including a ladle or crucible type melt receptacle.
- SEE OR SEARCH CLASS:
- 222, Dispensing, appropriate subclasses for dispensing means in general.
- 317** This subclass is indented under subclass 316. Apparatus wherein the pressure piston has an opening through which to convey pressurized metal towards the mold.
- 318** This subclass is indented under subclass 316. Apparatus which includes a fluid pressure operated piston-charger.
- (1) Note. The piston may be directly operated by the fluid pressure or the operating force may be generated by fluid pressure and transmitted by mechanical linkages.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 312, for a cold chamber type fluid actuated piston charger.
- 319** This subclass is indented under subclass 284. Apparatus wherein the pressure shaping means is a solid member which is applied to the metal after it is in the mold or otherwise confined.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 119, for a process of applying direct fluid secondary pressure to confined metal.
- 120, for a process of applying pressure after the introduction of metal into a confining means.
- 284, for means to apply a pneumatic secondary pressure force to confined metal.
- 320** This subclass is indented under subclass 319. Apparatus wherein the pressure means is an element which applies a pressure acting in a radially outward direction from a cavity in the product.
- 321** This subclass is indented under subclass 319. Apparatus which includes a fluid pressure actuated piston compression means.
- (1) Note. The inelastic compression member may either be directly or indirectly actuated by fluid force.
- 322** This subclass is indented under subclass 271. Apparatus which includes two or more molds which do not rely upon each other for shaping a complete product and are not filled by the same sprue, gate or runner.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 18, for process of shaping fluent material to sequentially form discrete molds.
- 129+, for a process of casting plural articles.
- 167, for mold shaping including metal casting means.
- 296, for centrifugal casting means having plural mold cavities.
- 350+, for sand type molds having individual mold cavities for forming plural products which are filled by a common sprue, gate or riser.
- SEE OR SEARCH CLASS:
- 249, Static Molds, subclass 81 and 119+ for static type molds having a community feature.
- 323** This subclass is indented under subclass 322. Apparatus which includes means to change the loci of the molds.
- (1) Note. To be included herein the mold must leave one locus for another. Mere movement at one locus is insufficient, e.g., moving mold parts together, tilting of a mold, etc.
- 324** This subclass is indented under subclass 323. Apparatus wherein the molds are moved, one after the other, in a circuit.
- 325** This subclass is indented under subclass 324. Apparatus wherein the moving means is a rigid structure carrying the molds in a generally circular circuit around its axis.

- 326** This subclass is indented under subclass 325. Apparatus wherein the table or wheel is mounted to turn around a vertical axis.

SEE OR SEARCH CLASS:

- 108, Horizontally Supported Planar Surfaces, subclasses 20+, for horizontal power driven tables.

- 327** This subclass is indented under subclass 326. Apparatus wherein the molds have two or more shaping parts which are moved relative to each other.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 137, for a mold assembling processes of this class.  
168, for mold shaping and assembling means including metal casting means.  
339+, for means to shape metallic material including means to assemble mold parts.  
364+, for a sand type shaping surface comprised of separable parts.  
377+, for a flask or flask section having size adjustable features.  
384+, for plural part flask or flask sections.

SEE OR SEARCH CLASS:

- 249, Static Molds, subclasses 155+, for a static container type mold having a size adjustable feature, subclasses 160+ for a static container type mold having plural mold sections and subclasses 184+ for a plural section static core member.

- 328** This subclass is indented under subclass 327. Apparatus which includes a cam surface which effects the relative movement of the separable parts.

- 329** This subclass is indented under subclass 324. Apparatus wherein the molds are moved in their circuit by a flexible, endlessly linked carrier.

- 330** This subclass is indented under subclass 329. Apparatus in which the serial molds each are made of two or more parts which are relatively movable.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 137, for mold assembling processes of this class.  
168, for mold shaping and assembling means including metal casting means.  
339+, for means to shape metallic material including means to assemble mold parts.  
364+, for a sand type shaping surface comprised of separate parts.  
377+, for a flask or flask section having size adjustable features.  
384+, for plural part flask or flask sections.

SEE OR SEARCH CLASS:

- 249, Static Molds, subclasses 155+ for a static container type mold having a size adjustable feature, subclasses 160+ for a static container type mold having plural mold sections and subclasses 184+ for a plural section static core member.

- 331** This subclass is indented under subclass 329. Apparatus which includes a mechanical member which contacts the mold or product to separate the cast product from the mold.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 344+, for means to shape metallic material including product ejection means; and the search notes thereto for apparatus of this class including ejector means.  
404+, for, per se, means to separate a cast product from a shaping member.

SEE OR SEARCH CLASS:

- 249, Static Molds, subclass 66.1, for static type molds including product ejecting means.

- 332** This subclass is indented under subclass 271. Apparatus which includes means for holding or positioning a preformed part, which is to become a part of the final cast product, in a mold during the casting operation.

- (1) Note. To be included in this and indented subclasses the preform must be disclosed as a desired element of the product.



SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 9+, for process of shaping a forming surface within which is embedded a preform which is to become part of the final product.
- 98+, for processes of forming a composite article wherein a preform is incorporated into the metal cast, particularly see subclass 112 for methods of positioning a preform relative to the shaping surface.
- 228, for means of pressure casting including means to hold or position a preformed product part.

SEE OR SEARCH CLASS:

- 249, Static Molds, subclasses 83+ for static molds means providing for uniting a preform with the metal being cast.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 259+, for processes of shaping and uniting material other than metal to a performed product part. See subclasses 275+ for processes of positioning or maintaining position of preform relative to mold surface.

**333** This subclass is indented under subclass 332. Apparatus having means for positioning plural preform bodies in a mold cavity.

- (1) Note. The plural preforms may be in contact or may be in spaced relationship.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 10+, for process of shaping a forming surface within which is embedded plural preform bodies which are to become an integral part of the final product.

**334** This subclass is indented under subclass 332. Apparatus having means other than the mold (core) surface for supporting or holding the preform body.

- (1) Note. A mere clamp, e.g., a device integral with or abutting a molding surface which also aids in supporting the preform, is not considered to be "other" support means.

- (2) Note. A separate and distinct means employed to support a preform in a particular location within the mold cavity where said means becomes a part of the cast product is considered to be within the scope of "other" support means and is included herein.

SEE OR SEARCH CLASS:

- 249, Static Molds, subclasses 91+ for static type molds including means other than the mold surface for supporting a preform body in the mold cavity.

**335** This subclass is indented under subclass 271. Apparatus including a receptacle or container for holding and/or dispensing the molten material into a shaping member.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 256, for vacuum systems including a melt receptacle.
- 437+, for continuous casting means having means to dispense or distribute a metal charge.
- 311, for front loading nozzle type pneumatic injection machines.

SEE OR SEARCH CLASS:

- 222, Dispensing, for dispensing type metal ladles.
- 249, Static Molds, subclasses 105+, for permanent-type shaping surface having static filling means.

**336** This subclass is indented under subclass 335. Apparatus wherein either (1) the melt receptacle is rotatable together with the mold to fill same or (2) a ladle, which removes a portion by dipping from a larger melt receptacle, turns over to dispense the charge into a mold.

**337** This subclass is indented under subclass 335. Apparatus with either a flow controller or conduit means located intermediate the mold and the molten metal dispenser for effecting discharge of the material into the mold.

**338.1** This subclass is indented under subclass 271. Including means to heat mold: Apparatus including means to heat the mold.

- (1) Note. The heating means may be integrated within the metal-shaping surface or external thereto.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 103+, for processes of preconditioning a preform by preheating said preform to perfect the bonding between it and the metal cast.
- 121, for processes of preconditioning apparatus by heating.
- 122+, for processes of controlling solidification by heating.
- 144, for heating means combined with means for casting printing plates.
- 250.1+, for means to directly apply electrical or wave energy to work including for heating purposes.
- 492, for processes of heating molten metal by electrical or wave energy while forming said metal against a shaping surface.

**SEE OR SEARCH CLASS:**

- 249, Static Molds, subclass 79 for a static metal mold having electric heating means; and subclass 80 for static metal mold having means within mold body to confine heat exchange medium.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 402+ for processes of heating nonmetal cast material by direct application of electrical or wave energy; and subclasses 319+ for processes of applying heat to a nonmetal cast material which is shaped against a forming surface.

**338.2 In situ chemical reactive heating means:**

This subclass is indented under subclass 338.1. Apparatus wherein the means to heat the mold includes chemically reactive material contained in some portion of the mold body.

- 339** This subclass is indented under subclass 271. Apparatus which includes means for positioning or maintaining mold parts in operational relationship before or during casting.

- (1) Note. The assembling means may encompass machine elements for effecting and maintaining mating mold parts in working engagement or may merely encompass means for positioning a cope and drag assembly.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 137, for processes of assembling mold parts.
- 168, for mold shaping and assembling means combined with a metal casting station.
- 292, for centrifugal casting means having mold or mold part clamping means.
- 374+, for mold flasks, per se.
- 377+, for size adjustable flasks.
- 385+, for plural part flasks having alignment means.
- 394+, for mold jackets or slip boxes, per se.

**SEE OR SEARCH CLASS:**

- 249, Static Molds, subclasses 106+, for plural part metal molds having assembly means.
- 269, Work Holders, appropriate subclasses for a "clamp" means, per se, to grasp or draw portions of a mold or flask either together or onto a base or support.

- 340** This subclass is indented under subclass 339. Apparatus wherein the assembly means are for effecting placement of a core section into operational engagement with a mold cavity.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

- 30+, for process of shaping a composite mold structure wherein the position of the core is maintained relative to the mold.
- 370, for a sand type shaping surface including a core with integral aligning means.
- 397+, for core centering or supporting means, per se.

**SEE OR SEARCH CLASS:**

- 249, Static Molds, subclass 177 for a core element of that class including means to attach the core to a support.

**341** This subclass is indented under subclass 339. Apparatus having additional means for locking the assembled mold parts in operational engagement.

- (1) Note. The locking means may cooperate with the assembly means but must be in addition thereto.

SEE OR SEARCH CLASS:

249, Static Molds, subclass 167 for plural mold sections having removable means to maintain assembly including a clamp means and subclasses 168+ for plural mold sections having fastening means.

**342** This subclass is indented under subclass 339. Apparatus wherein the mold parts assembled consist of permanent members.

- (1) Note. A permanent mold is one which is reusable several times and is generally constructed of metal.
- (2) Note. Sand resin mold structures, e.g., shell molds are not considered permanent mold structures to be placed herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

303+, for injection pressure shaping means.

**343** This subclass is indented under subclass 342. Apparatus wherein fluid pressure actuated means effects the positioning of the permanent mold parts into assembled relationship.

- (1) Note. The fluid pressure may act either directly or indirectly upon the mold parts.

**344** This subclass is indented under subclass 271. Apparatus including means to remove or withdraw a cast product from a forming surface or vice versa.

- (1) Note. The removal or withdrawal may be with respect to a mold or core or both.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 131+, for processes of removing a product from a forming surface.
- 145, for means of stripping cast printing plates.
- 180, for means to withdraw mold parts after shaping a forming surface.
- 213, for means for separating mold from shaping member subsequent to its formation.
- 295, for means to remove product from centrifugal casting means.
- 401+, for means, per se, to eject or strip product from shaping surface.
- 441+, for apparatus means for continuous or semi-continuous casting including a product withdrawal means.

SEE OR SEARCH CLASS:

- 249, Static Molds, subclass 66.1, for metal shaping surface including means to remove or release product from said surface; subclass 136, for static mold with a bottom movable through upstanding mold walls to aid product removal; subclasses 178+, for internal mold means (core) including means to contract core thereby aiding its removal from a product and subclass 183, for flexural shaping surface means which characteristic aids in product removal.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 334+, for processes of separating non-metal molded article from shaping surface.

**345** This subclass is indented under subclass 344. Apparatus having means for separating a core from the cast product.

- (1) Note. The apparatus found herein may also effect removal of the cast product from the mold in addition to performing a core removal operation.

SEE OR SEARCH THIS CLASS, SUBCLASS:

132, for processes of core removal.

## SEE OR SEARCH CLASS:

249, Static Molds, subclasses 63+ for a static mold including a core and means to remove the core.

- 346** This subclass is indented under subclass 345. Apparatus wherein the core means utilized is constructed of sectional or plural parts to facilitate removal from the cast product.

(1) Note. The plural parts of the core may be movably attached and thusly collapsible or may be composed of loose pieces.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

369, for a sand type shaping surface including a core member.

## SEE OR SEARCH CLASS:

249, Static Molds, subclasses 178+ for expandible and/or contractible metal cores and subclass 184 for plural section cores.

- 347** This subclass is indented under subclass 344. Apparatus wherein push element means, e.g., ejector pins, are utilized for contacting the cast product and affecting separation from the forming surface.

(1) Note. The ejector pins may or may not be an integral part of the forming surface.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

406, for ingot stripping pin means, per se.

- 348** This subclass is indented under subclass 271. Apparatus including means to apply coolant to mold or casting or means within its surface to confine a heat exchange medium.

(1) Note. Coolant means may be integrated within the mold body or external thereto.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

122+, for processes of controlling solidification, particularly subclasses 126 and 128 for processes of utilizing a cooling liquid.

144, for printing plate casting means having auxiliary cooling means.

297, for means to apply coolant to centrifugal casting means.

443+, for continuous or semicontinuous casting means having a casting material cooling means.

## SEE OR SEARCH CLASS:

249, Static Molds, subclasses 79+, for permanent type static metal mold having means within its surface to confine heat exchange medium; and subclass 111 for static mold including solid heat conductor, e.g., chill.

- 349** This subclass is indented under subclass 271. Apparatus wherein the shape imparting surface is composed of particles which retain their individual identity and are bonded or adhered to one another.

(1) Note. The shaping surface in this and indented subclasses are static, i.e., the shaping surface does not move in any way, once they are assembled, in order to effect shaping of the cast metal.

(2) Note. By the term "sand" is meant granular particles resulting from the breakdown of rocks. Sand particles have refractory characteristics. The term includes "silica sand" from quartz and other siliceous rocks which comprises 50 to 95 per cent of the total material in any molding sand; specially sands such as zirconite and olivine. Also included are other particular material such as carbon, clays, etc.

## SEE OR SEARCH THIS CLASS, SUBCLASS:

165+, for means to make shell type molds.

169+, for means to shape molds from particulate materials.

348, for sand mold including cooling means.

## SEE OR SEARCH CLASS:

249, Static Molds, for metal molds having a sand coated shaping surface. The sand coating takes the shape of the metal mold and does no shaping, per se.

- 350** This subclass is indented under subclass 349. Apparatus wherein the sand type shaping surface has more than one cavity for forming a separate and distinct product.
- (1) Note. The plural cavities are filled through a common sprue.
- (2) Note. The products produced may be totally different in design.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
322+, for plural independent molds not filled through a common sprue.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclasses 119+, for plural article forming static nonsand type molds.
- 351** This subclass is indented under subclass 350. Apparatus having an inner removable core in at least one of the mold cavities.
- (1) Note. The combination of a mold and internal core is found in this class so long as one of the elements is composed of sand.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
30+, for process of forming plural part shaping surface and positioning core relative to a forming surface.  
98+, for process of forming a composite article by embedding a preform in or surrounding it with cast metal, e.g., a metal tubular core of one composition could be positioned in a sand mold and metal of a different composition cast therearound so as to form a tubular product.  
302, for centrifugal casting means including a core means.  
340, for apparatus means to position core within a mold.  
345+, for means to eject core from mold after casting has solidified.  
348, for core member having coolant means therein.  
365+, for plural separable part molds, e.g., sand molds comprising a cope and drag and numerous cores, in which intricate shapes are cast such as radiators and crankshafts.
- 369, for sand cores, per se.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclass 63, for metal mold including core; subclasses 142+, for metal mold having inner removable core for forming recess or opening in the material cast; subclasses 175+, for metal cores (internal molds), per se.  
264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 271.1 process of shaping plastic material and embedding preform therein.
- 352** This subclass is indented under subclass 349. Apparatus comprising a shaping surface and metal chill combination.
- (1) Note. A metal chill may be embedded within the sand-type shaping surface or on the surface thereof. In the latter case, the chill aids in shaping the cast metal. In the prior case the chill acts merely as a heat conductor.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
80, material introduced into mold as a solid where, e.g., the purpose is to avoid shrinkage.  
98+, process of casting metal into contact with preform within the mold cavity and embedding the preform within the shaped material.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclass 111, for nonsand type static mold having solid heat conductor or insulator.
- 353** This subclass is indented under subclass 352. Apparatus where the metal chill is a part of the sand-type shaping surface.
- 354** This subclass is indented under subclass 353. Apparatus wherein the shaping surface of which the chill is a part is a surface which shapes an internal portion of a product.

**355** This subclass is indented under subclass 353. Apparatus wherein two or more spaced chill sections act as part of the shaping surface.

**356** This subclass is indented under subclass 353. Apparatus wherein the shaping surface comprises a metal chill which is annular and has a hole which shapes a portion of a product intermediate its ends.

SEE OR SEARCH CLASS:

249, Static Molds, subclass 57 for static molds which produce a ring type product.

**357** This subclass is indented under subclass 352. Apparatus wherein the chill is incorporated within the cast metal product.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

9, for process of making sand mold wherein product part is embedded in the mold material.  
80, for process of molding metal wherein material, e.g., a consumable chill, is introduced into the mold as a solid.  
107, for process of making a composite article wherein a preform is a chill member.  
127, for processes of casting wherein a chill member is utilized to effect localized or zone heat dissipation.  
236, for chill supporting pattern members.  
371, for chills, per se, if the chills are used as a means to shape metallic material.  
412, consumable chills, per se.

SEE OR SEARCH CLASS:

249, Static Molds, subclass 111 for a static nonsand mold including a chill member.

**358** This subclass is indented under subclass 349. Apparatus having apertured filter means for preventing the inclusion of unwanted components, e.g., dross, dirt, oxides, etc., in the cast product.

(1) Note. The strainer element to be included herein must have three or more apertures or openings.

(2) Note. The apertured strainer element may be located in the gate, runner, sprue or riser portions of the mold.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

61+, for processes of casting utilizing a vacuum.  
134, for processes of casting including the step of separating an unwanted component from the melt.  
254+, for casting apparatus having means for applying vacuum directly to the molten casting material.  
337, for casting apparatus including a melt receptacle having flow control means intermediate the receptacle and mold.  
362, for a sand type shaping surface having nonapertured segregating means for separating unwanted components from the molten cast metal.

**359** This subclass is indented under subclass 349. Apparatus having means to provide a reservoir of molten metal for feeding into the mold cavity proper as the metal in the mold solidifies to compensate for liquid shrinkage.

(1) Note. The reservoir, e.g., riser, hot top sink head, etc., must be designed to furnish additional metal to the mold cavity proper after the teeming has ceased.

(2) Note. In a top pouring mold the sprue, gate and riser are often integrated.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

45, for processes of making patterns which may have a riser shaping portion.  
80, for processes of controlling pipe by insertion of solid metal into the mold as the cast metal solidifies.  
120, for processes of pressure casting involving a secondary pressure application to densify the cast metal.  
122+, for methods of controlling solidification of the cast metal.  
162, for apparatus means for shaping risers.  
244, for pattern means to shape sprue.

## SEE OR SEARCH CLASS:

249, Static Molds, subclass 82 metal mold having means to adjust mold volume during molding, subclasses 105+ for static filling means in contact with mold cavity, and subclasses 197+ for sink head or hot top, per se.

**360** This subclass is indented under subclass 359. Apparatus wherein the feeding reservoir, i.e., riser, does not extend to the mold surface.

(1) Note. Generally the blind risers are closed to the atmosphere by a cap or plug, however, the blind riser may be vented.

(2) Note. The blind riser may be positioned intermediate the mold cavity proper and the sprue.

**361** This subclass is indented under subclass 349. Apparatus wherein the shaping surface is a thin shell-like mold formed from thermosetting resin-bonded sand mixtures.

(1) Note. Generally the shell mold consists of two or more parts, i.e., cope and drag.

(2) Note. The shell mold may be externally backed up with steel shot, sand, or similar material.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

21, for processes of shaping shell type molds by spraying resin containing particulate material against a shaping surface.

165+, for shell type molding machine to shape a forming surface.

520+, for processes of shaping shell type molds.

**362** This subclass is indented under subclass 349. Apparatus having runner or gate splash and swirl control means, e.g., runner bushes, runner traps, etc., for providing laminar flow of the molten metal into the mold cavity proper.

(1) Note. Included herein are molds with gates and runners having specific geo-

metrical shape for reducing flow turbulence.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

133+, for processes of introduction control or manipulation of charge.

244, for combination pattern means including means to shape a sprue, gate or runner.

337, for metallic shaping means combined with a melt receptacle having flow control or conduit means intermediate the receptacle and mold.

358, for a sand type shaping surface including an apertured strainer means.

## SEE OR SEARCH CLASS:

249, Static Molds, subclasses 105+ for metal mold including static filling means, e.g., see subclass 107 for inlet communicating with plural feeding passages; and subclass 206, for a splash control for a static nonsand type mold.

**363** This subclass is indented under subclass 349. Apparatus wherein the runner for feeding the molten metal into the mold cavity proper is located at or near the bottom of the cavity or is constructed so as to feed the metal in a substantially horizontal flow path into the cavity.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

242, for gated patterns match plates.

244, for pattern means including means to shape gate.

304, for injection casting apparatus having a valved gate.

## SEE OR SEARCH CLASS:

249, Static Molds, subclass 109 for non-sand static molds having material inlet to cavity at or near the bottom of cavity.

**364** This subclass is indented under subclass 349. Apparatus comprising a multipart shaping surface which parts are relatively movable.

(1) Note. A shaping surface having merely a cope and a drag is subject matter for these subclasses.

## SEE OR SEARCH CLASS:

249, Static Molds, subclass 64 for metal mold having plural cores; subclasses 142+ for permanent container type molding apparatus having an inner removable core; and subclasses 160+ for container type molding device having plural mold sections.

- 365** This subclass is indented under subclass 364. Apparatus wherein one of the separate parts is a member to be positioned in a mold to provide a product cavity.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

302, for centrifugal casting means including core means.  
 351, for a mold having a core within each of a plurality of molding cavities.  
 369+, for sand cores, per se.

## SEE OR SEARCH CLASS:

249, Static Molds, subclass 63 for non-sand type static mold including core and means to remove the core; and subclasses 142+ for nonsand type static mold including a removable core.

- 366** This subclass is indented under subclass 365. Apparatus wherein the core contains and at least partially surrounds an element which aids in strengthening or holding the core, sand or aids in positioning the core relative to a mold.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

379+, for flasks having means to reinforce or retain mold sand.  
 397+, for core centering or supporting means, per se.

- 367** This subclass is indented under subclass 366. Apparatus wherein the embedded component is hollow.

(1) Note. The component must be hollow when the core member is functioning as a core in a molding operation to be included herein.

- 368** This subclass is indented under subclass 365. Apparatus wherein there is included either (1) two or more individual cores or (2) a core which has two or more separable parts.

- 369** This subclass is indented under subclass 349. Apparatus wherein the shaping surface is a member which is to be positioned in a mold to provide a product cavity.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

30+, for processes of maintaining position of core while shaping a composite, plural part or multilayered mold from fluent mold material.  
 228+, for means to form sand cores.  
 302, for centrifugal casting means including core means.  
 340, for means to position core within an assemble of mold parts.  
 345+, for means to shape metal material having in combination means to eject the core from the product.  
 351, for sand mold having a core within each of a plurality of molding cavities.  
 365+, for separable part shaping surface (including plural part cores) where one element is a core.

## SEE OR SEARCH CLASS:

249, Static Molds, subclasses 63+ for metal molding including metal core means; subclasses 122+ for container-type metal molds for forming plural articles including a core; subclasses 142+ for container-type molding device having inner removable core; and subclasses 175+ for static, non-sand type cores.

- 370** This subclass is indented under subclass 369. Apparatus having means integral with the core so that it can by those means be positioned in a certain way within a mold cavity.

## SEE OR SEARCH THIS CLASS, SUB-CLASS:

366+, for a core having embedded sand reinforcing or supporting component in a shaping surface assembly.



- 397+, for core centering or supporting means, per se.
- 371** This subclass is indented under subclass 271. Apparatus directed to a, per se, member which forms a part of the mold shaping surface and which has a heat conductivity much greater than that of the remaining parts of the mold.
- (1) Note. A chill for this subclass must be disclosed for use in a sand-type shaping surface and must aid in the actual shaping of the cast material.
- (2) Note. The chills found herein generally comprise a formed metal shaping surface.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 107, for process of compositing by shaping metal and uniting to a preform which is utilized to chill the cast metal.
- 127, for a casting process employing a chill member to control solidification.
- 138, for a casting process utilizing a particular shaping surface material.
- 348, for metal shaping apparatus including particular means to apply coolant.
- 352+, for sand-type shaping surface in combination with a metal chill.
- 412, for a, per se, chill member which does not form a part of the mold shaping surface.
- SEE OR SEARCH CLASS:
- 249, Static Molds, subclass 111 for static nonsand molds including a chill.
- 372** This subclass is indented under subclass 371. Apparatus wherein the chill has openings in its surface to allow gas to escape.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 410, for vent or vent forming apparatus.
- 373** This subclass is indented under subclass 371. Apparatus wherein the chill surface is in continuous arcuate form.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 356, for a sand type shaping surface including an annular chill member.
- 374** This subclass is indented under the class definition. Apparatus directed to a container or box for confining mold material while the same is being shaped.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 237+, for patterns combined with flasks.
- 375** This subclass is indented under subclass 374. Apparatus which includes a means facilitating oscillatory movement of the flask about an axis through the flask or at one side of the flask.
- (1) Note. Hinged superposed flasks are not considered subject matter for this subclass, see subclasses 392+ below.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:
- 183+, for rock-over and roll-over type compacting machines which include a pattern withdrawal means.
- 205, for a vibrating molding machine with roll or rock-over feature.
- 209, for a press molding machine with an invertible table.
- 224, for shaping apparatus having inverting means.
- 402, for stripping means including pattern inverting means.
- 409, for, per se, means for inverting a pattern or mold member.
- 376** This subclass is indented under subclass 374. Apparatus wherein the flask is one in which material for making a precision-casting (last-wax or investment casting) mold is to be contained therein.
- (1) Note. An investment mold, which to be contained in the type of flask of this subclass, is characterized by the mold being formed around and embedding a destructible pattern.

- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
34+, for processes of forming molds wherein the pattern is destroyed to remove it.
- SEE OR SEARCH CLASS:  
249, Static Molds, subclass 54 for static dental type molds.
- 377** This subclass is indented under subclass 374. Apparatus wherein the flask includes means to change the dimensions of the flask.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
392+, for flasks having separable sides with various means to join the sides.
- 378** This subclass is indented under subclass 377. Apparatus wherein the adjustable feature of the flask part is for varying the size of the vertical dimension.
- 379** This subclass is indented under subclass 374. Apparatus which includes means to (1) help maintain the sand in the flask (2) held strengthen the sand or (3) provide for locating strengthening members.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
411, for reinforcement, per se, for mold material.
- 380** This subclass is indented under subclass 379. Apparatus where the sand mold retaining means is a strip at the base of the flask section which overlies a portion of the mold periphery.
- 381** This subclass is indented under subclass 380. Apparatus wherein the sand strip is removable from the flask by a structural element actuating the strip.
- 382** This subclass is indented under subclass 379. Apparatus wherein the reinforcement is suspended and extends downwardly in the flask.
- 383** This subclass is indented under subclass 379. Apparatus wherein the retention of the mold sand is facilitated by contiguous formations on or in the flask at the general parting line between the sand mold proper and the flask.
- 384** This subclass is indented under subclass 374. Apparatus wherein the flask or flask section is composed of more than one separable part.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
364+, for plural separable part sand type shaping surface.  
377, for plural part flask wherein parts are assembled to vary size of the flask.  
379+, for flask including means to retain or reinforce mold sand or to position reinforcement.
- 385** This subclass is indented under subclass 384. Apparatus having means to aid in precise adjustment or correct relative positioning of superposed flask section.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
137, for processes of assembling mold parts.  
168, for means to shape a forming surface combined with metal casting means including means for assembling shaped mold parts.  
339+, for means to shape metallic material including means to assemble mold parts.
- 386** This subclass is indented under subclass 385. Apparatus which includes an actuatable means operable during or after assembly to fasten the superposed sections and prevent their relative vertical movement.
- 387** This subclass is indented under subclass 385. Apparatus wherein the guide means is contained in the flask walls.
- 388** This subclass is indented under subclass 385. Apparatus wherein the guide means are capable of ready change or easy expansion to bring the flask or contraction part to a true or more effective relative positioning.
- 389** This subclass is indented under subclass 388. Apparatus wherein the guide means is composed of expansible or contractable material.

- 390** This subclass is indented under subclass 388. Apparatus wherein the adjustability by means of a threaded fastening member is variably positioned in a slotted member.
- 391** This subclass is indented under subclass 385. Apparatus wherein the superposed flask sections are provided at a common meeting edge with a pivot means to allow relative swinging movement at the edge.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
375, for flask having turn over means.
- 392** This subclass is indented under subclass 384. Apparatus in which a flask section has a joint where the side parts are not permanently attached to one another.
- 393** This subclass is indented under subclass 392. Apparatus having a joint permitting motion in one plane between the adjacent panel section.
- 394** This subclass is indented under the class definition. Apparatus directed to a container or enclosure for positioning around a sand mold to prevent the mold from spreading or breaking down when molten metal is poured into the cavity therein.
- (1) Note. The mold jacket or slip box may function to align portions of plural part molds.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
374+, for mold shaping flasks or flask sections.  
411+, for internal mold reinforcement members.
- SEE OR SEARCH CLASS:  
269, Work Holders, appropriate subclasses for a "clamp" means, per se, to grasp or draw portions of a mold or flask together.
- 395** This subclass is indented under subclass 394. Apparatus having means by which the size of the jacket can be altered.
- (1) Note. The mold jackets and slip boxes found herein are of the flexible or non-fixed type.
- (2) Note. The size of the jacket or slip box may be altered to adapt the same to molds having different taper or to different size molds.
- 396** This subclass is indented under subclass 395. Apparatus having panel walls thereof so joined together that they individually adapt themselves to the surface on which they are placed.
- (1) Note. The panel walls to be self-adjustable must act independent of the will of the operator.
- 397** This subclass is indented under the class definition. Apparatus adapted for insertion in a mold to support or position a core body relative to the mold.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
230+, for means for shaping a composite core which includes means for positioning a preformed part.  
366+, for separable part sand molds with a core having reinforcement.
- 398** This subclass is indented under subclass 397. Apparatus wherein the supporting or positioning means consists of a member which extends from a core surface to a support surface to space the surfaces.
- 399** This subclass is indented under subclass 398. Apparatus wherein the chaplet is positioned by a portion extending through the core surface or the supporting surface or by means associated with the core and supporting surface.
- 400** This subclass is indented under subclass 397. Apparatus wherein the core supporting means is intended to extend inside the core and is constructed to allow a break down or reduction in volume of the means.
- 401** This subclass is indented under the class definition. Apparatus which has means to disassociate a shaping surface from the shaped product.

- (1) Note. Included herein are patents directed to apparatus for stripping sand from flasks.
- (2) Note. The shaped produce can either be a cast product or a shaped mold structure.
- (3) Note. Included herein is, per se, apparatus utilized to disassociate a pattern or core member from a mold structure by fluidizing or liquifying.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 34+, for processes of destroying a pattern to disassociate the same from a shaped mold.
- 44, for mechanical pattern withdrawal processes.
- 180+, for mold material compacting apparatus having means for withdrawing the forming surface from the shaping means.
- 213+, for mold shaping apparatus including means for separating the forming surface from the shaping means.
- 402** This subclass is indented under subclass 401. Apparatus including means for inverting a pattern or pattern plate member.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 183+, for mold material compacting apparatus including an invertible pattern and having pattern withdrawal means.
- 205, for vibratory mold material compacting apparatus of the roll or rock-over type.
- 209, for a press type compactor having an invertible table.
- 224, for mold shaping apparatus having pattern inverting means.
- 409, for, per se, means to invert a pattern plate or mold.
- 403** This subclass is indented under subclass 401. Apparatus directed to fluid pressure means for stripping or ejecting a pattern member.
- 404** This subclass is indented under subclass 401. Apparatus directed to per se means for stripping or withdrawing a cast product part from a mold or core member.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 131, for a process of removing a cast article from a forming surface.
- 344, for shaping apparatus including means to eject or separate product from shaping surface.
- SEE OR SEARCH CLASS:
- 209, Classifying, Separating, and Assorting Solids, appropriate subclasses for method and apparatus involving the use of an agitating screen as the sole means for disintegrating a sand mold or core, regardless of whether the mold or core is in molding association with a casting or flask.
- 241, Solid Material Comminution or Disintegration, appropriate subclasses for processes and apparatus for disintegrating a mold or core, not associated with a flask or casting and not involving abrading or a sifting or other assorting means.
- 405** This subclass is indented under subclass 404. Apparatus directed to means for stripping or withdrawing cast ingots from their molds.
- (1) Note. Means for stripping a cast ingot from an ingot stool is included herein.
- 406** This subclass is indented under subclass 405. Apparatus wherein pin or rod plunger means projecting through or adapted to be projected through an opening in the mold bottom are utilized to contact the cast ingot and to dislodge or strip the said ingot from its mold.
- 407** This subclass is indented under subclass 405. Apparatus directed to means which strip the mold from the ingot by raising or lifting the mold vertically upwardly away from engagement with the cast ingot.
- (1) Note. The molds stripped herein are generally of the big and down type.

- 408** This subclass is indented under subclass 407. Apparatus wherein fluid pressure actuated means effects the stripping of the mold from the ingot.
- 409** This subclass is indented under the class definition. Apparatus directed to means actuable for inverting a pattern plate shaping member or flask about a horizontal axis.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 183+, for molding machines including withdrawal means having means for inverting pattern, flask, or shaping member.
- 205, for roll or rock-over vibrator type molding machine.
- 209, for press type molding machines having an invertible table.
- 375, for roll or rock-over flasks.
- 410** This subclass is indented under the class definition. Apparatus which includes or consists of either (1) a means for allowing otherwise trapped gases to escape from the apparatus or (2) means to form such escape means.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 234, for core shaping means including a vent or vent forming means.
- 372, for vented chills.
- 397+, particularly subclass 400 for vented core supporting means.
- SEE OR SEARCH CLASS:
- 249, Static Molds, subclass 141 for a static mold which includes an auxiliary part for transmission of fluid, i.e., vent or drain.
- 411** This subclass is indented under the class definition. Apparatus which includes or consists of a member which is to internally support or strengthen the fluent material making up a mold or core.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
- 366, for core reinforcement in a sand mold.
- 379+, for a flask having means to reinforce the sand.
- 412** This subclass is indented under the class definition. Apparatus not provided for above.
- (1) Note. Included in this subclass among other apparatus are, consumable chills, mold weights, rapping plates and wear inserts.
- SEE OR SEARCH CLASS:
- 16, Miscellaneous Hardware, subclass 403 for a paper weight and 404 for miscellaneous weights.
- 413 Control or product withdrawal means in continuous casting apparatus:**  
This subclass is indented under subclass 154. Apparatus wherein the means controlled includes means for removing a continuously cast product from the mold.
- 414 Control of coolant applied to continuously cast product:**  
This subclass is indented under subclass 154. Apparatus wherein the means controlled applies an agent to remove heat from a continuously cast product.
- 415 In continuous casting apparatus:**  
This subclass is indented under subclass 259. Apparatus wherein the inert or deoxidizing atmosphere is provided in conjunction with a mold means which forms a portion of a product as a previously formed contiguous portion of the product is removed from the mold.
- 416 In continuous casting mold:**  
This subclass is indented under subclass 260. Apparatus wherein the vibratory motion is transmitted to a mold means employed to form a portion of a product as a previously formed contiguous portion of the product is removed from the mold.
- 417 Including continuous casting apparatus:**  
This subclass is indented under subclass 270.1. Apparatus including a mold means employed to form a portion of a product as a contiguous portion of the product is removed from the mold.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 413, 414 and 449.1+, for continuous casting apparatus with condition-responsive control means.
- 415, for continuous casting apparatus including means to provide an inert or reducing atmosphere.
- 416, for continuous casting apparatus with means to vibrate the mold.
- 417, for continuous casting apparatus combined with means to perform an operation which is, per se, not of this class and is not a perfecting means for an operation of this class.
- 452+, and 460+, for continuous casting methods.

**418 Continuous or semicontinuous casting:**

This subclass is indented under subclass 271. Apparatus wherein a mold means is employed to form a portion of a product as a previously formed contiguous portion of the product is removed from the mold.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 413, 414 and 449.1+, for continuous casting apparatus with condition-responsive control means.
- 415, for continuous casting apparatus including means to provide an inert or reducing atmosphere.
- 416, for continuous casting apparatus with means to vibrate the mold.
- 417, for continuous casting apparatus combined with means to perform an operation which is, per se, not of this class and is not a perfecting means for an operation of this class.
- 459+, for continuous casting methods.

SEE OR SEARCH CLASS:

- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, subclasses 67+ for plastic filament-forming or film-casting means comprising a shaping orifice discharging into a liquid bath, and subclasses 224+ for means casting fluent stock on a shaping surface with means to provide a continuous length product.

**419 Including means to convey preformed product part to mold:**

This subclass is indented under subclass 418. Apparatus which includes a means to relatively advance a preformed article part of the mold area.

- (1) Note. Also included herein are those patents wherein a means is included to convey a mold past a preform while continuously forming a metal layer on the preform.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 268, for coating a continuously cast product outside of the mold area.

SEE OR SEARCH CLASS:

- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 171.1+ for process of continuously forming composite nonmetallic products.

**420 Plural distinct shaping outlets:**

This subclass is indented under subclass 418. Apparatus including either (1) plural mold means, or (2) means for simultaneously forming a plurality of products.

**421 Hollow casting:**

This subclass is indented under subclass 418. Apparatus wherein the product formed contains a central cavity.

**422 Rotary mold:**

This subclass is indented under subclass 421. Apparatus wherein the mold includes means enabling rotation about its axis to thus form the central cavity by centrifugal force upon the molten metal.

**423 Filament or wire casting:**

This subclass is indented under subclass 418. Apparatus wherein the product formed is a strand-like member.

**424 Including shape-perfecting means:**

This subclass is indented under subclass 418. Apparatus including means subsequent to the mold means for refining the shape of a partially solidified product.

- 425 Including starter bar:**  
This subclass is indented under subclass 418. Apparatus including means to initially close the mold exit.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
445, for a starter bar, per se.
- 426 Disconnectable:**  
This subclass is indented under subclass 425. Apparatus wherein means are provided to enable the starter bar to be separated from the product during the casting operation.
- (1) Note. A starter bar is considered to be “separated from the product” even though a part of the bar, or “head”, remains with the casting.
- (2) Note. The separation must be performed prior to any severing operation.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
446, for a disconnectable starter bar, per se.
- 427 Continuously advancing mold part:**  
This subclass is indented under subclass 418. Apparatus wherein the mold means includes a shaping surface which moves through, and out of, the casting zone.
- 428 Roll couple mold:**  
This subclass is indented under subclass 427. Apparatus wherein a pair of similar revolvable cylinders provides the moving shaping surface.
- 429 Endless shaping means:**  
This subclass is indented under subclass 427. Apparatus wherein the moving shaping surface is carried on or comprises the outer peripheral surface of either (1) an annular or cylindrical member, or (2) an endless belt or band.
- 430 Articulated segments (e.g., caterpillar type, etc.):**  
This subclass is indented under subclass 429. Apparatus wherein the moving shaping surface comprises a plurality of flexibly connected rigid elements, which, when in abutting relationship, define the shaping surface.
- 431 With plural belts of flexible material:**  
This subclass is indented under subclass 430. Apparatus including a plurality of endless bands, each of which comprises a continuous strip of pliant material cooperating with the flexibly connected rigid elements to define the mold means.
- 432 Plural belts of flexible material:**  
This subclass is indented under subclass 429. Apparatus including a plurality of endless bands, each formed of a continuous strip of pliant material.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
431, for plural belts of flexible material which employ caterpillar-type shaping means.
- 433 Casting wheel and flexible band:**  
This subclass is indented under subclass 429. Apparatus wherein the endless shaping means includes an annular or cylindrical member with a circumferential casting groove and an adjacent endless band formed of a pliant material, wherein the shaping area is defined by the groove and band.
- 434 With dispensing feature:**  
This subclass is indented under subclass 433. Apparatus wherein significance is attributed to means for supplying molten metal to the shaping area (e.g., adjustable tundish, specific pour tube structure, etc.).
- 435 Having deformable mold wall or thermal expansion compensating means:**  
This subclass is indented under subclass 418. Apparatus wherein the mold wall, or a portion thereof, either (1) yields to accommodate casting operation forces, or (2) includes means specifically provided to accommodate temperature reactive forces during the casting operation.
- 436 Adjustable mold size:**  
This subclass is indented under subclass 418. Apparatus wherein the cross-sectional area of the mold cavity may be selectively varied.

- 437 Including means to dispense or distribute metal charge:**  
This subclass is indented under subclass 418. Apparatus including means to control or direct the supply of molten metal to the mold.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
449.1+, for supply means controlled in response to a variable condition.
- SEE OR SEARCH CLASS:  
222, Dispensing, subclasses 591+ for molten dispensers, per se.  
266, Metallurgical Apparatus, subclasses 236+ for discharging vessels for molten metal which include means for treating the same.
- 438 Movable dispenser:**  
This subclass is indented under subclass 437. Apparatus wherein the supply means is mounted for some form of movement (e.g., ladle car, tilting tundish, etc.).
- 439 Mold contiguous with or within dispenser:**  
This subclass is indented under subclass 437. Apparatus wherein the mold is mounted inside or in contact with the supply means during the casting operation.
- (1) Note. "Supply means" includes funnels or molten metal reservoirs fixed to, or integral with, the mold.
- 440 Dispensing into horizontal mold:**  
This subclass is indented under subclass 439. Apparatus wherein the molten metal enters and flows through the mold means in a substantially horizontal direction.
- 441 Including product supporting or withdrawal means:**  
This subclass is indented under subclass 418. Apparatus including means subsequent to the mold means to remove or hold the product.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
413, for product withdrawal means controlled in response to a variable condition.
- 447, for product-supporting or withdrawal means, per se.
- 442 Roller:**  
This subclass is indented under subclass 441. Apparatus wherein the means to remove or support the product includes an annular or cylindrical member which rotates and contacts the product at points on its periphery.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
448, for product supporting or withdrawing rollers, per se.
- 443 Having casting material cooling means:**  
This subclass is indented under subclass 418. Apparatus including means to positively apply an agent to remove heat from the casting material.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
384, for means to apply coolant to a mold or casting generally.  
414, for means to apply coolant to a casting with control means responsive to a variable condition.
- 444 Direct cooling of material:**  
This subclass is indented under subclass 443. Apparatus wherein the casting material is directly contacted by the cooling agent.
- 445 STARTER BAR:**  
This subclass is indented under the class definition. Apparatus comprising means to initially close the exit of a continuous casting mold.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
425, for a starter bar in combination with a mold means.
- 446 Disconnectable:**  
This subclass is indented under subclass 445. Apparatus wherein means are provided to enable the starter bar to be separated from the product during the casting operation.
- SEE OR SEARCH THIS CLASS, SUB-CLASS:  
426, for a disconnectable starter bar in combination with mold means.



**447 PRODUCT SUPPORTING OR WITHDRAWAL MEANS FOR CONTINUOUS CASTING APPARATUS:**

This subclass is indented under the class definition. Apparatus comprising means to remove or hold a product subsequent to its formation in and while still connected to a continuous casting mold.

SEE OR SEARCH THIS CLASS, SUBCLASS:

441, for withdrawal means claimed in combination with mold means.

- (1) Note. For original placement in this subclass, a patent claim must recite a structural limitation (e.g., cooling jacket, surface coating, etc.) which renders the support or withdrawal means peculiar to the subject matter of this class.

**448 Roller:**

This subclass is indented under subclass 447. Apparatus wherein the means to remove or hold the product includes an annular or cylindrical member which rotates about its axis and contacts the product at points on its periphery.

SEE OR SEARCH THIS CLASS, SUBCLASS:

442, for roller means claimed in combination with mold means.

**449.1 In continuous casting apparatus:**

This subclass is indented under subclass 155.2. Apparatus which produces a continuously cast product.

- (1) Note. See GLOSSARY for a definition of "continuous casting."

**450.1 Including sensor comprising electrode or float:**

This subclass is indented under subclass 449.1. Apparatus including means for detecting the process parameter comprising either an electrically conductive probe or a buoyant means.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclasses 290+, particularly subclasses 305+, for a device for measuring liquid level using a float.

**450.2 Including radioactive sensor:**

This subclass is indented under subclass 449.1. Apparatus including means for detecting the level of molten metal in the supply, mold, or a component of the apparatus comprising means responsive to alpha, beta, or gamma particle emission.

SEE OR SEARCH CLASS:

250, Radiant Energy, subclass 308 for apparatus to inspect solids or liquids including a radioactive source and subclasses 336.1+ for invisible radiant energy responsive electric signaling devices, per se.  
252, Compositions, subclasses 625+ for radioactive compositions, per se.  
976, Nuclear Technology, digests 410+ for devices to convert radioactive energy into electrical energy.

**450.3 Including thermal sensor:**

This subclass is indented under subclass 449.1. Apparatus having means for detecting a process parameter related to heat (e.g., temperature, heat transfer rate, etc.) of the melt, product, or apparatus, per se.

SEE OR SEARCH CLASS:

73, Measuring and Testing, subclass 295 for a thermal device to measure liquid level.  
374, Thermal Measuring and Testing, subclass 54 for a device to determine fluid volume from a thermal measurement.

**450.4 Including optical sensor:**

This subclass is indented under subclass 449.1. Apparatus having means for detecting the level of molten metal in the supply or mold comprising light detection means.

- (1) Note. This subclass includes patents directed to the detection of both endophotonic (i.e., light generated by the melt or mold itself) and exophotonic

(i.e., light generated by an external source) energy.

- (2) Note. A patent claiming control of feed material in response to detection or recognition of an image related to the melt or mold is classified here.

**SEE OR SEARCH CLASS:**

- 73, Measuring and Testing, subclass 293 and 323+ for a device to measure liquid level using illumination or sight glass.  
382, Image Analysis, appropriate subclasses for image recognition or processing, per se.

**450.5 Including magnetic sensor:**

This subclass is indented under subclass 449.1. Apparatus including means for detecting the level of the substance in the supply, mold, or component of the apparatus comprising means for detecting variation in a local magnetic field.

**SEE OR SEARCH CLASS:**

- 73, Measuring and Testing, subclass 290 for a device to measure liquid level.  
324, Electricity: Measuring and Testing, subclasses 200+ for a device, or subcombination thereof, to sense or indicate the sensing of a magnetic field.

**451 Of continuous or semicontinuous casting:**

This subclass is indented under subclass 4.1. Process wherein the testing, sampling, or inspecting or condition determination is performed in conjunction with casting a product removed from a molding surface as a further contiguous portion is cast.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 415, for continuous casting apparatus provided with inert or reducing gas atmosphere means.  
416, for a continuous casting mold provided with vibrator means.  
417, for a continuous casting apparatus combined with other structure not provided for in this class.  
418+, for continuous or semicontinuous casting apparatus, per se.

447+, for product supporting or withdrawal means utilized for continuous casting apparatus.

459+, for continuous or semicontinuous casting processes without measuring, testing, inspecting, or controlling steps.

502+, for continuous or semicontinuous casting apparatus including means to apply magnetic forces.

505+, for continuous or semicontinuous casting apparatus utilizing means to apply electrical or wave energy to work material.

**452**

**And regulating an operation:**

This subclass is indented under subclass 451. Process wherein a detected variation in a casting parameter is utilized to affect an operation or effect a change to an operation in response to the variation.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 122+, for casting processes controlling solidification.  
144, for apparatus for casting printing plates including positive mold cooling means.  
154.1+, for casting apparatus provided with responsive control means.  
157, for casting apparatus provided with control means responsive to an independent timer.

**SEE OR SEARCH CLASS:**

- 73, Measuring and Testing, subclasses 864.01+ for measuring and testing samplers or tollers for measuring liquid in a receptacle.

**453**

**Pouring:**

This subclass is indented under subclass 452. Process wherein the effected operation or change includes the delivery of molten metal to a shaping or casting area.

**SEE OR SEARCH THIS CLASS, SUBCLASS:**

- 133+, for processes of casting including an introduction control or manipulation of charge step.

488+, for continuous or semicontinuous casting processes provided with a specific molten metal pouring step.

**SEE OR SEARCH CLASS:**

222, Dispensing, subclass 590 for processes of dispensing molten metal.

**454 Product withdrawing:**

This subclass is indented under subclass 452. Process wherein the effected operation or change includes removing a continuously cast product from a molding surface.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

441+, for continuous or semicontinuous casting means including a product supporting or withdrawal means.

447+, for a product supporting or withdrawal means for a continuous casting apparatus.

**455 Cooling:**

This subclass is indented under subclass 452. Process wherein the effected operation or change includes an application of an agent to remove heat from a shaping surface or a continuously cast product.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

443+, for continuous or semicontinuous casting means having casting material cooling means.

458, for casting processes provided with measuring, testing, or inspecting steps including a cooling step.

485+, for continuous or semicontinuous casting processes provided with specific mold or product cooling steps.

**456 During foundry sand treating or mold making:**

This subclass is indented under subclass 4.1. Process wherein the testing, sampling, or inspecting or condition determination is performed while foundry mold material is in the process of being either (a) shaped, or (b) treated (e.g., recycled).

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

6, for processes of shaping a forming surface.

**457 During feeding of metal to mold:**

This subclass is indented under subclass 4.1. Process wherein the testing, sampling, or inspecting or condition determination is performed in conjunction with the introduction of solid or liquid metal into a mold cavity.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

133+, for casting processes provided with a charge introduction or manipulation step.

437+, for continuous or semicontinuous casting means provided with means to dispense or distribute a metal charge.

449.1+, for casting apparatus provided with control means responsive to material level in a continuous casting apparatus.

**SEE OR SEARCH CLASS:**

373, Electric Furnaces, subclass 42 for processes of charging or discharging devices in electric furnaces.

**458 During cooling of mold:**

This subclass is indented under subclass 4.1. Process wherein the testing, sampling, or inspecting or condition determination is associated with the removal of heat from a shaping surface.

**SEE OR SEARCH THIS CLASS, SUB-CLASS:**

443+, for continuous or semicontinuous casting means provided with casting material cooling means.

485+, for continuous or semicontinuous processes provided with a specific mold or product cooling step.

**459 Continuous or semicontinuous casting:**

This subclass is indented under subclass 47. Process wherein a portion of a cast product is removed from a forming mold or surface as a further contiguous portion is cast.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 413, for continuous casting apparatus provided with product withdrawal control means.
- 414, for continuous casting product coolant control means.
- 415, for continuous casting apparatus provided with inert or reducing gas atmosphere means.
- 416, for a continuous casting mold provided with a vibrator means.
- 417, for a continuous casting apparatus provided for means other than a perfecting feature or specifically provided for in a class other than 164.
- 418+, for continuous or semicontinuous casting apparatus.
- 447+, for a product supporting or withdrawal means in a continuous casting apparatus.
- 449.1+, for a continuous casting apparatus provided with responsive control means responsive to material level.
- 502+, for continuous casting apparatus including means to directly apply magnetic forces.
- 505+, for continuous casting apparatus provided with means to directly apply electrical or wave energy to work.

**460 Including product cutting or breaking:**

This subclass is indented under subclass 459. Processes which includes the step of finishing the cast product by mechanically cutting or breaking the cast product while a contiguous portion thereof is still associated with the forming mold.

- (1) Note. Refer to Class 164, class definition, References to Other Classes, in the reference to Class 29 for the line between Class 29 and Class 164.
- (2) Note. Flame cutting is considered mechanically cutting for purposes of this subclass.
- (3) Note. The term "mold" as used herein includes (a) the core or cores, (b) core-like elements associated with gate portions of the casting and used for handling, and (c) conveying means serv-

ing to support a continuous casting while said casting is still associated with the mold.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 70.1, for a casting step provided with a product trimming, cutting, or breaking step.
- 78, for processes of incorporating a product dividing member during casting.
- 140, for apparatus to cast printing plates including means for cutting or trimming the casting.
- 161+, for apparatus for shaping a forming surface, e.g., mold, including cutting or sweeping means.

SEE OR SEARCH CLASS:

- 29, Metal Working, subclass 527.6 for processes of metal casting followed by a cutting or removing step.
- 249, Static Molds, subclass 52 for static molds employing a static means to produce a groove or depression in the product to facilitate breaking or cutting.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 161 for flash or sprue removal in a plastic molding operation.

**461 Forming a composite article:**

This subclass is indented under subclass 459. Process wherein the product is multipart or multilayered with at least two distinctive zones of metal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 91+, for processes of producing composite article.
- 496, for casting processes directly applying electrical or wave energy to work by electrical discharge forming composite articles.

**462 Forming filament, wire or ribbon:**

This subclass is indented under subclass 459. Process wherein the cast product formed is a thin rod, rodlike or striplike member.

- (1) Note. Included herein are patents unique by the nature of the product produced.

Such patents will not generally be cross-referenced into following process subclasses unless a feature is disclosed or appears to have general utility in other continuous casting processes.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

423, for continuous or semicontinuous casting means used to form filaments or wires.

**463 Utilizing continuously advancing surface:**  
This subclass is indented under subclass 462. Process wherein the member is formed by a forming mold or surface which constantly moves into, through, and out of the molding area.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

427, for continuous casting apparatus provided with means to continuously advance a mold part.

479+, for other continuous casting processes utilizing a continuously shaping surface.

**464 Forming a hollow article:**  
This subclass is indented under subclass 459. Process wherein the cast product formed contains a central cavity.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

421+, for continuous or semicontinuous casting means utilized to form hollow castings.

451, for processes of continuously forming hollow products by centrifugal force.

**465 Using a core or mandrel:**  
This subclass is indented under subclass 464. Process wherein the central cavity is shaped by applying molten metal to an external surface of a forming mold.

**466 Utilizing magnetic force:**  
This subclass is indented under subclass 459. Process wherein a magnetic field is applied to work material or to the cast product.

(1) Note. The term work material implies solid or molten metal, a thixotropic state

thereof, i.e., solid-liquid mixture, or a slurry of such metal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

147.1+, for casting apparatus utilizing electromagnetic means.

498+, for casting processes utilizing magnetic energy.

**467 Molten metal shaped by electromagnetic field:**

This subclass is indented under subclass 466. Process wherein molten metal is contained and formed into a desired shape by the application of an electromagnetic field.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

503, for electromagnetic mold means in casting continuous casting apparatus.

**468 Applying electromagnetic stirring force to molten metal within mold or product:**

This subclass is indented under subclass 466. Process wherein molten metal within a mold or entrained by the outer skin of a cast product is circulated by an electromagnetic field.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

499, for casting processes utilizing magnetic energy to stir molten metal.

504, for continuous casting apparatus utilizing electromagnetic stirring means.

**469 Utilizing electric arc or electron beam melting:**

This subclass is indented under subclass 459. Process including raising the temperature of work material to its molten state through either (a) electric arc discharge between an electrode and the work material, or (b) electron beam bombardment upon the work material.

(1) Note. Included herein is the use of two electrically charged metal rods adapted to form an electric arc wherein both are melted to supply casting material and also the use of a single charged rod in a consumable electrode of suitable material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 494, for casting processes utilizing electron beams to heat the work material.
- 495, for casting processes using electrical arc discharges to heat the work material.
- 506, for continuous casting apparatus utilizing electron beam melting means to melt the work material.
- 508, for continuous casting apparatus utilizing arc electrodes to apply heat to work material.
- 514, for casting apparatus utilizing arc electrodes to apply electrical energy to work material.

SEE OR SEARCH CLASS:

- 373, Electric Furnaces, subclass 42 for electric arc furnace structures, per se; and subclass 68 for electron beam type electric furnaces.

#### **470 Electric arc melting with slag or flux:**

This subclass is indented under subclass 469. Process wherein an electrical arc discharge is utilized to raise the work material to its molten state with the simultaneous application of slag or flux.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 497, for casting processes utilizing electrical arc discharges for heating the work material with the application of slag or flux.

#### **471 Utilizing induction heating:**

This subclass is indented under subclass 459. Process including raising the temperature of work material by placing the work material within an induction coil, the work material thereby constituting the secondary of a transformer or a continuation of the induction coil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 493, for casting processes utilizing electrical induction heating means.
- 513, for casting apparatus utilizing coil induction heating means.

SEE OR SEARCH CLASS:

- 373, Electric Furnaces, subclass 140 for electrical induction furnaces, per se.

#### **472 Including lubricating of mold surface:**

This subclass is indented under subclass 459. Process including the step of applying a lubricant to the forming mold or surface.

SEE OR SEARCH CLASS:

- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclass 169 and 213 for processes of utilizing a lubricant and indefinite length plastic work forming.

#### **473 Incorporating additional material or chemically reactive agent:**

This subclass is indented under subclass 459. Process wherein a material is directly added to the molten metal to either be alloyed therewith, cause chemical reaction therewith, or to produce a slag.

- (1) Note. The added material may include principle alloying constituent, densifiers, fluidizers, graphitizers, scavengers, grain-size controllers, etc.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 55.1+, for casting processes incorporating an addition or chemically reactive metal to metal casting material.

SEE OR SEARCH CLASS:

- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for processes for producing metals.
- 423, Chemistry of Inorganic Compounds, subclasses 1+ for processes of chemically treating mixtures to obtain metal-containing compound.

#### **474 Utilizing a vacuum:**

This subclass is indented under subclass 459. Process including exhausting air or other gases from the immediate contiguous environment of a casting material to a negative pressure differ-

ential with respect to the surrounding ambient environment of the casting material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

7.1+, for processes of applying a vacuum in a mold-forming operation.

SEE OR SEARCH CLASS:

75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for vacuum treatment of metals.

264, Plastic and Nonmetallic Article Shaping or Treating: Processes, subclasses 500+ for processes of vacuum forming plastic materials; and subclasses 101+ for processes of vacuum treating work.

**475 With inert or reducing gaseous atmosphere:**  
This subclass is indented under subclass 459. Process wherein work material is subjected to an inert or reducing gaseous environment.

(1) Note. An ambient atmosphere which may be inert is not included herein.

SEE OR SEARCH CLASS:

75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, various subclasses for processes for gaseous treating of metals.

148, Metal Treatment, subclasses 633+ or 712+ for combined processes of significant heat treatment of solid or semi-solid metal and treatment with a special gaseous composition.

**476 With metal working:**  
This subclass is indented under subclass 459. Process which includes alteration of the size or shape of the cast product by deforming (e.g., rolling) while a contiguous portion is being cast.

SEE OR SEARCH CLASS:

29, Metal Working, subclasses 527.7+ for processes of casting, including a rolling operation.

148, Metal Treatment, subclasses 538+ for processes of casting and working that includes significant heat-treatment after removal from the mold to modify or maintain the internal physical structure (i.e., microstructure) or chemical properties of the metal.

**477 With diverse treatment:**

This subclass is indented under subclass 459. Process which includes an operation which is, per se, neither of this class nor a perfecting step for an operation of this class.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

270.1, for apparatus of Class 164 combined with apparatus provided for in other classes.

SEE OR SEARCH CLASS:

29, Metal Working, subclasses 527.1+ for a combined casting and manufacturing process wherein the manufacturing step is performed after removing the cast product from the mold.

**478 Having mold or product vibration or reciprocation:**

This subclass is indented under subclass 459. Process wherein the forming surface is oscillated relative to the product.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

39, for vibratory treatment of molding materials.

416, for continuous casting molds including a vibrator means.

SEE OR SEARCH CLASS:

148, Metal Treatment, subclass 558 for processes of treating solid or semi-solid metal outside the mold with high frequency vibration.

**479 Having continuously advancing shaping surface:**

This subclass is indented under subclass 459. Process wherein the forming mold or surface constantly moves into, through, and out of the molding area.

- (1) Note. The molding area is any or all of that contiguous portion between the molten metal and forming mold or surface.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 427, for continuous casting apparatus provided with means to continuously advance a mold part.

**480 Utilizing roll couple mold:**

This subclass is indented under subclass 479. Process wherein the forming mold or surface moving through the molding area is provided by a pair of similar revolving cylinders.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 428, for continuous advancing mechanisms in a continuous casting apparatus in the form of a roll couple mold.

**481 Utilizing endless plural belts:**

This subclass is indented under subclass 479. Process wherein the forming mold or surface moving through the molding area includes a plurality of endless bands of pliant material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 429+, for continuous advancing means in a continuous casting apparatus in the form of endless plural belts.

**482 Utilizing wheel-band mold:**

This subclass is indented under subclass 479. Process wherein the forming mold or surface moving through the molding area includes an annular or cylindrical member with a casting groove and an adjacent cooperating endless band of pliant material covering a section of the groove.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 433+, for continuous advancing means in a continuous casting apparatus in the form of a cooperating casting wheel and flexible band.

**483 Starting up or ending casting process:**

This subclass is indented under subclass 459. Process wherein significance is attributed to a step of either initiating or stopping the casting operation.

**484 Specific product withdrawal:**

This subclass is indented under subclass 459. Process wherein significance is attributed to a step of removing the cast product from the forming mold or surface as a contiguous portion is being formed.

- (1) Note. Included herein are patents which usually include a unique article removal operation. Patents which incidentally disclose or claim a removal step are cross-referenced here only where such step appears to be atypical.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 413, for a continuous casting apparatus provided with product withdrawal control means.  
441+, for continuous casting apparatus provided with product supporting or withdrawal means.  
447+, for product supporting or withdrawal means, per se, for continuous casting apparatus.

**485 Specific mold or product cooling:**

This subclass is indented under subclass 459. Process wherein significance is attributed to a step of actively applying a heat exchange medium to remove heat from the forming mold or surface, or the cast product.

- (1) Note. The step of actively applying a heat exchange medium implies a manipulative operation of bringing into thermal contact with the work material a substance, generally a solid or liquid, thereby producing the cooling effect.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

- 414, for continuous casting apparatus provided with control means responsive to a coolant applied to the product.  
443+, for continuous casting apparatus having casting material cooling means.



- 486 Directly applying liquid coolant to product:**  
This subclass is indented under subclass 485. Process wherein the cast product is cooled by having a cooling liquid physically contact the product.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
126, and 128, for processes of controlling solidification by a cooling liquid.  
348, for a shaping means including means to apply a coolant.
- 487 Direct chill casting:**  
This subclass is indented under subclass 486. Process wherein the liquid impinges on the cast product immediately below the mold and flows downwardly over the surface of the cast product.
- 488 Specific molten metal dispensing:**  
This subclass is indented under subclass 459. Process wherein significance is attributed to the dispensing of molten metal into a forming mold or surface.
- (1) Note. Included herein, generally, are patents which include a unique pouring operation, i.e., other than ordinary teeming; patents which incidentally disclose or claim a pouring step are cross-referenced here only where such step appears to be atypical.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
437+, for continuous or semicontinuous casting apparatus including means to dispense or distribute a metal charge.  
449.1+, for supply means controlled in response to a variable condition.
- SEE OR SEARCH CLASS:  
222, Dispensing, subclass 500 for processes of dispensing molten metal; and subclasses 591+ for molten metal dispensers, per se.  
266, Metallurgical Apparatus, subclasses 236+ for discharging vessels for molten metal which include means for treating the same.
- 373, Electric Furnaces, subclass 42 for charging or discharging device processes in electric furnaces.
- 489 Including flow stream deflection or other than vertical dispensing:**  
This subclass is indented under subclass 488. Process in which molten metal introduced into a forming mold or surface is either (a) deflected in a controlled manner by a downstream structure, or (b) dispensed at other than the usual vertical direction.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
440, for continuous casting apparatus provided with means to dispense or distribute metal charge into a horizontal mold.
- 490 Dispensing into horizontal mold:**  
This subclass is indented under subclass 489. Process wherein the molten metal enters and flows through the forming mold or surface in a substantially horizontal direction.
- 491 Adjusting mold size:**  
This subclass is indented under subclass 459. Process including a step of changing the cross-sectional dimension of the forming mold or surface.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
436, for continuous casting apparatus provided with adjustable molds.
- 492 To electrically heat work material:**  
This subclass is indented under subclass 48. Process in which the electrical field or force functions to effect heating of the work material.
- SEE OR SEARCH CLASS:  
75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 10.1+ for electrothermic processes for purification or melting of metals.  
219, Electric Heating, appropriate subclasses for processes of heating by electrical means.

**493 By electrical induction:**

This subclass is indented under subclass 492. Process directed to raising the temperature of the work material by the electrical generation of heat within the work material disposed in an induction coil, the work material thereby constituting the secondary of a transformer or a continuation of the induction coil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

513, for casting apparatus provided with coiled induction means to directly apply electrical energy to work.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for electrical induction heaters, per se.  
373, Electric Furnaces, subclass 140 for induction furnaces, per se.

**494 By electron beam:**

This subclass is indented under subclass 492. Process directed to raising the temperature of the work material by bombardment with electron beams emitted from a source.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

506, for continuous casting apparatus provided with electron beam melting means.  
512, for casting apparatus provided electron beam melting means.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 121.12+ for electrical heating of metal utilizing electron beams.  
373, Electric Furnaces, subclass 68 for electron beam furnace heaters.

**495 By arc discharge:**

This subclass is indented under subclass 492. Process directed to raising the temperature of the work material by use of an electric arc discharge between an electrode and the work material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

508, for continuous casting apparatus utilizing an electrical arc electrode means for applying energy to work.  
514, for casting apparatus utilizing an electric arc electrode heating means.

SEE OR SEARCH CLASS:

219, Electric Heating, for metal heating utilizing arc devices.  
373, Electric Furnaces, subclass 42 for arc furnaces structure, per se.

**496 Composite article forming:**

This subclass is indented under subclass 495. Process in which a multilayered article having distinctive zones of metal is formed by either casting a metal onto a preform or casting two or more metals into contact with one another.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

91+, for processes of compositing in general.

SEE OR SEARCH CLASS:

228, Metal Fusion Bonding, appropriate subclasses for the formation of a metallic bonded joint between parts or portions of the same part. Molten filler material may be confined or retained by the shape or space between the parts so long as a mold device is not employed.

**497 With application of slag or flux:**

This subclass is indented under subclass 495. Process wherein a molten slag bath or flux blanket covers the melted metal.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 73.1+ for metal heating including electrosag welding.

**498 Utilizing magnetic energy:**

This subclass is indented under subclass 48. Process in which an induced positive magnetic field is applied to the work material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

147.1+, for casting apparatus utilizing electromagnetic means to apply a magnetic force thereto.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.

**499 For stirring molten metal:**

This subclass is indented under subclass 498. Process in which magnetic lines of force produce circulatory motion in a liquid metal.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

504, for continuous casting apparatus provided with electromagnetic stirring means.

**500 In transporting molten metal:**

This subclass is indented under subclass 498. Process wherein electromagnetic forces are used to convey molten metal to the mold, e.g., as a pump or valve would be used to convey the metal.

**501 Utilizing sonic or supersonic wave energy:**

This subclass is indented under subclass 48. Process wherein the wave energy is specifically of the sonic or supersonic range.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

250.1+, for casting apparatus provided with means to directly apply electrical or wave energy to work.

SEE OR SEARCH CLASS:

148, Metal Treatment, subclass 558 for processes of treating solid or semi-solid metal outside the mold with high frequency vibration.

**502 In continuous casting apparatus:**

This subclass is indented under subclass 147.1. Apparatus wherein a mold means is employed to form a portion of a product as a previously formed contiguous portion of the product is removed from the mold.

**503 Electromagnetic mold:**

This subclass is indented under subclass 502. Apparatus wherein the electromagnetic energy generates forces normal to the surface of molten metal to laterally confine the molten metal during solidification.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.

**504 Electromagnetic stirring means:**

This subclass is indented under subclass 502. Apparatus in which the electromagnetic energy is utilized to cause molten metal within the mold or entrained by the outer skin of a cast product to be circulated.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.

**505 In continuous casting apparatus:**

This subclass is indented under subclass 250.1. Apparatus provided with a mold means employed to form a portion of a product as a previously formed contiguous portion of the product is removed from the mold.

**506 Electron beam melting means:**

This subclass is indented under subclass 505. Apparatus wherein the means to apply an energy quantity comprises means for raising the temperature of work material to its molten state by a bombardment of an electron beam upon the work material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

512, for casting apparatus provided with electron beam melting means.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 121+ for electron beam metal heaters.  
373, Electric Furnaces, subclass 68 for electron beam furnaces.

**507 Induction heating means:**

This subclass is indented under subclass 505. Apparatus wherein the means to apply an energy quantity comprises means to raise the temperature of work material by placing the work material within an induction coil, the work material thereby constituting the secondary of a transformer or a continuation of the induction coil.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

513, for casting apparatus provided with electrical coil induction means.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.  
373, Electric Furnaces, subclass 140 for electrical induction furnaces, per se.

**508 Arc electrode melting means:**

This subclass is indented under subclass 505. Apparatus wherein the means to apply an energy quantity comprises means to raise the temperature of work material to its molten state by the utilization of an electric arc discharge between an electrode and the work material.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

514, for casting apparatus provided with electrical arc heating means.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 121.11+ for electrical heaters for melting metal.  
373, Electrical Furnaces, subclass 42 for electric arc furnaces, per se.

**509 Electroslag remelting type apparatus:**

This subclass is indented under subclass 508. Apparatus wherein a molten slag bath or flux blanket covers the molten material in the mold.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

515, for casting apparatus provided with electric arc electroslag remelting apparatus.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 73.1+ for metal heating including electroslag welding.

373, Electric Furnaces, subclass 42 for electric arc furnaces, per se.

**510 Electrical discharge knockout means:**

This subclass is indented under subclass 250.1. Apparatus wherein foundry molds are stripped from castings by means utilizing high-voltage electrical discharges.

**511 High frequency vibration means:**

This subclass is indented under subclass 250.1. Apparatus wherein the energy quantity applied to the work material is of the sonic or super-sonic vibration type.

**512 Electron beam melting means:**

This subclass is indented under subclass 250.1. Apparatus wherein the means to apply an energy quantity comprises means for raising the temperature of the work material by the utilization of a bombardment of an electron beam upon the work material.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 121.11+ for metal heating utilizing electron beam heating.

373, Electric Furnaces, subclass 68 for electrical induction furnaces utilizing electron beam heating.

**513 Induction coil means:**

This subclass is indented under subclass 250.1. Apparatus wherein the means to apply an energy quantity comprises a high frequency induction coil for heating the work material.

(1) Note. The material to be heated is placed in the high frequency magnetic field produced by the induction coil means wherein eddy currents and sometimes hysteresis losses created in the work serve to heat the material.

SEE OR SEARCH CLASS:

219, Electric Heating, subclasses 600+ for inductive heating, subclasses 678+ for microwave heating, and subclasses 764+ for capacitive dielectric heating.

- 373, Electric Furnaces, subclass 140 for electrical induction furnaces, per se.
- 514 Arc electrode:**  
This subclass is indented under subclass 250.1. Apparatus wherein the means to apply an energy quantity comprises an electrical circuit producing an electrical discharge between the electrode to the work material.
- (1) Note. Consumable as well as nonconsumable electrodes are provided in this subclass.
- SEE OR SEARCH CLASS:  
219, Electric Heating, subclasses 121.11+ for electrical arc metal heating means.  
373, Electric Furnaces, subclass 42 for electric arc furnaces, per se.
- 515 Electroslag remelting type apparatus:**  
This subclass is indented under subclass 514. Apparatus wherein a molten slag bath or flux blanket covers the molten material in the mold.
- SEE OR SEARCH CLASS:  
219, Electric Heating, subclasses 73.1+ for metal-heating means including electroslag welding.  
373, Electric Furnaces, subclass 42 for electric arc furnace structure, per se.
- 516 Utilizing aqueous slurry material:**  
This subclass is indented under subclass 24. Process wherein mold materials, at least in part, are suspended in a water solution.
- SEE OR SEARCH CLASS:  
75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for process of treating metals and alloys.  
106, Compositions: Coating or Plastic, subclasses 38.2+ for mold or mold-coating composition.
- 517 With particular material for treating or perfecting casting:**  
This subclass is indented under subclass 516. Process wherein a specific mold material is utilized to physically or chemically treat the cast product to either physically enhance its properties or to prevent physical or chemical degradation of the cast product.
- 518 With particular binder:**  
This subclass is indented under subclass 516. Process wherein significance is attributed to binding material utilized in shaping a mold structure.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
523, and 524, for synthetic resins or natural rubber having a filler material.
- 519 With particular refractory material:**  
This subclass is indented under subclass 516. Process wherein significance is attributed to refractory material utilized in shaping a mold structure.
- 520 Utilizing particular mold materials:**  
This subclass is indented under subclass 15. Process wherein specific mold materials are utilized in shaping a mold structure.
- SEE OR SEARCH THIS CLASS, SUBCLASS:  
138, for molds of a particular composition.  
516+, for processes of forming composite molds using slurry and particular materials.
- SEE OR SEARCH CLASS:  
75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, appropriate subclasses for process of treating metals and alloys.  
106, Compositions: Coating or Plastic, subclasses 38.2+ for mold or mold coating compositions.
- 521 Self-hardenable molding material:**  
This subclass is indented under subclass 520. Process wherein the mold materials utilized require no other chemicals or additives to solidify into a solid material.
- 522 Water soluble mold material:**  
This subclass is indented under subclass 520. Process wherein the molding materials are capable of being removed from the casting surface by dissolution in an aqueous solution.

**523 To perfect casting surface:** END

This subclass is indented under subclass 520. Process wherein specific molding materials are utilized to enhance the physical properties of the surface of the cast product.

**524 To prevent casting oxidation:**

This subclass is indented under subclass 520. Process wherein specific mold material are utilized to produce a chemical reaction providing an inert or reducing environment for the cast product.

**525 Particular binder material:**

This subclass is indented under subclass 520. Process wherein significance is attributed to binding material utilized in shaping a mold structure.

**526 Resin containing:**

This subclass is indented under subclass 525. Process wherein a resin-containing binder is utilized in shaping a mold surface.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

523, and 524, for synthetic resins or natural rubber having a filler material.

**527 And inorganic material:**

This subclass is indented under subclass 526. Process wherein the binder includes a resin and an inorganic material, both utilized for shaping a mold surface.

**528 Inorganic material:**

This subclass is indented under subclass 525. Process wherein an inorganic-containing binding is utilized for shaping a mold structure.

**529 Particular refractory material:**

This subclass is indented under subclass 520. Process wherein significance is attributed to refractory material utilized in shaping a mold structure.

## CROSS-REFERENCE ART COLLECTIONS

**900 RHEO-CASTING**

This subclass is indented under the class definition. Cross-reference art collection drawn to rheo-casting.